From the house of **Amar Chitra Katha** and **Tinkle**

BRAINWAVE™

SCIENCE IS JUST A GAME

Vol. 02 Issue 10
October 2013
48 pages
8-15 years
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Join 39k other fans

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LEAD START
Publishing

The interview (Expert Talk) was classy and the choice of the toy 'Bottle Light' was excellent. This is one of my favourites. 3 weeks ago, Prof. Ashok Sen FRS visited us - he had just won the Padma Bhushan. Kayomarz will be delighted to see Prof. Sen having a peek at the bottle light.
- Arvind Gupta, Scientist and Educator, about the February 2013 issue, Inventions & Discoveries

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SOME SOUND FACTS

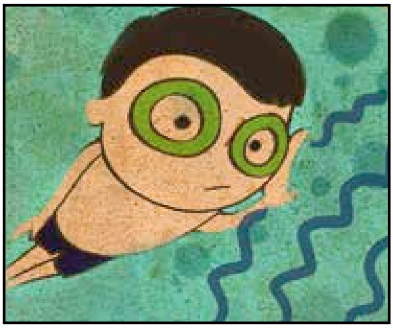
Dear young friends,

Thank you for the wonderful suggestions on how to make the editor's note interesting. I heard you. I shall try out a different advice each time!

Let's get started with a cool fact about sound - city officials in London have started playing classical music onto the streets in high crime areas, in order to discourage criminal activity. And it worked - within 18 months, robberies and vandalism dropped by 33%! This act is based on the science that when you hear music you don't like, your dopamine[G] production is suppressed, putting you in a bad mood and making you want to avoid it.

The tongue twister this time is simple. Ask your friends and family to say *'a proper copper coffee pot'* 5 times in quick succession!
SK, sasikanth.c@ack-media.com

Cover artwork by **Saudamini Tambay**



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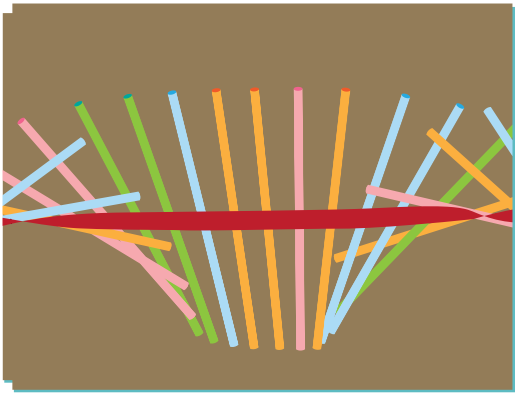
■✚

SOUND FACTS

In which we blow our own whistle, meet the human sound machine, trick our ears by swapping sounds, hear whales sing and more, ultimately learning some sound facts ...



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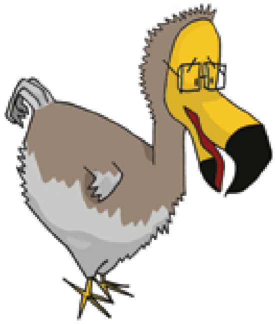
★ Win a gift!

MEET THE SMARTIES

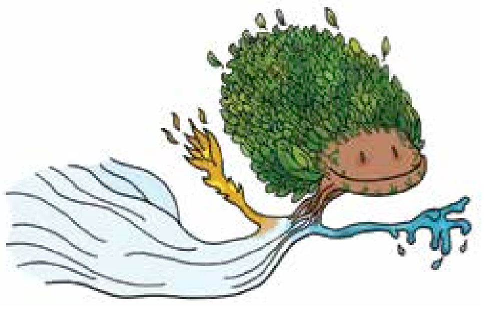


Dr. Dodo: Dr. Dodo is the co-founder of BW Labs and is the last living dodo. He holds a PhD in anachronomaly and parallel universes from the University of Clockwindistan. He invented the Galileo series of time machines.

Skree!: Skree! is the other founder of BW Labs. She loves dangerous experiments. She makes mini black holes before breakfast and has dark matter for lunch.

Arby: Arby is a genius who will grow up to be Aryabhata. He came to the future, thanks to Dr. Dodo's time machine. He is a fan of numbers, banana fritters and robot wars.

Mr X: Mr. X, short for Xavier, was once Dr. Dodo's student. X is as brilliant as Alby and Arby, and by virtue of his knowledge of science, as powerful as Bhoo when the situation demands.



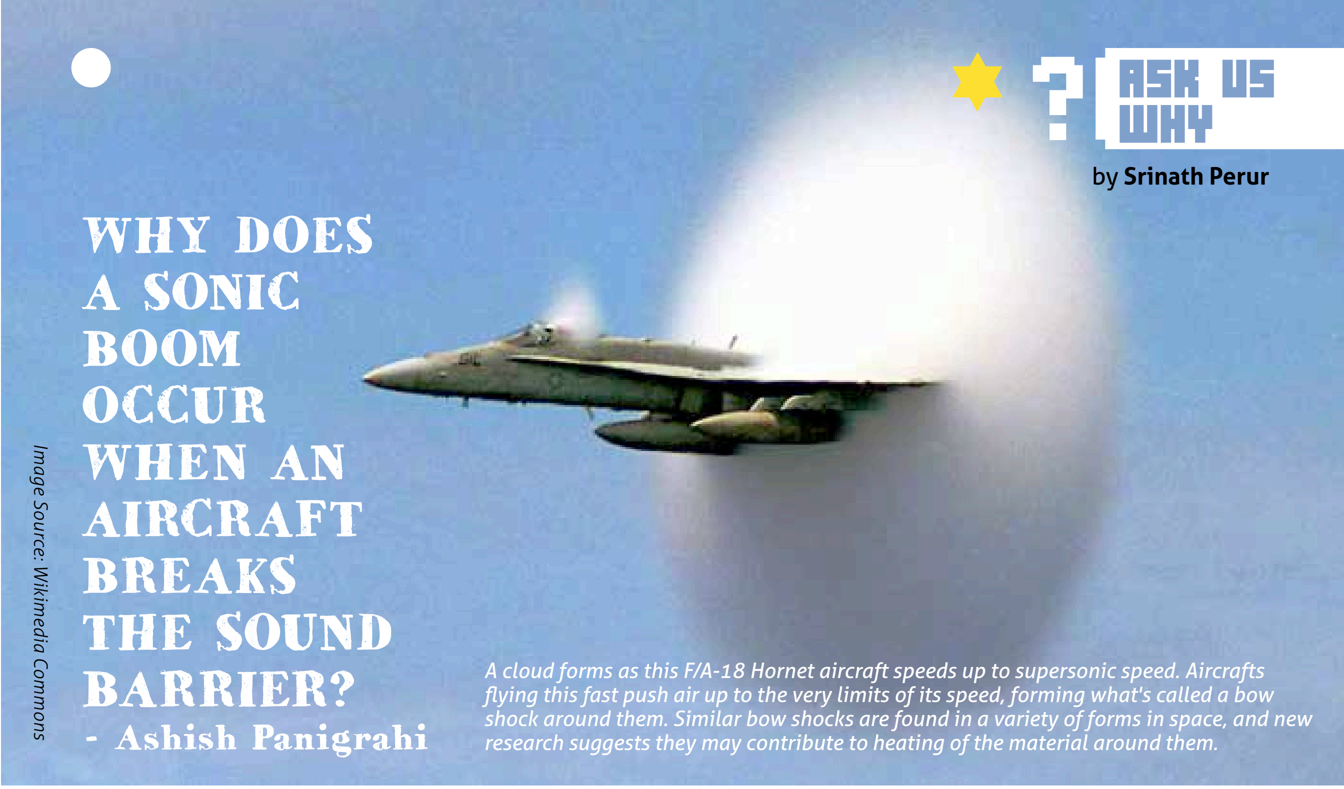
Bhoomi: Bhoomi, a.k.a. Bhoo, is an enigma. No one knows where she is from and how she came into being. She is made up of earth, wind, fire and water in equal parts. Her alter-ego is Gaia Goel, a world famous science sleuth.

Alby: Alby will grow up to be Albert Einstein However, now, like Arby, he too has been sucked into the future. When he is not researching, he plays the violin.

Read more at www.bwmag.in/meet-the-smarties by **Srinath Perur**

WHY DOES A SONIC BOOM OCCUR WHEN AN AIRCRAFT BREAKS THE SOUND BARRIER?

- Ashish Panigrahi



A cloud forms as this F/A-18 Hornet aircraft speeds up to supersonic speed. Aircrafts flying this fast push air up to the very limits of its speed, forming what's called a bow shock around them. Similar bow shocks are found in a variety of forms in space, and new research suggests they may contribute to heating of the material around them.

Image Source: Wikimedia Commons

A sonic boom is that thunder like sound you hear when a fighter plane flies overhead. It is made by objects moving faster than sound.

When an object moves through the air, it creates pressure waves in all directions around it. The speed of these waves is the same as the speed of sound. Now, if a plane flies faster than the speed of these pressure waves, they compress into a high-pressure cone around the plane. This is similar to the wake of a boat or ship moving through water.

Now, imagine that plane flying towards you. What do you hear? Nothing! Because the pressure waves you hear as sound are behind the plane. When the plane flies past and that high-pressure cone reaches you: boom!

You don't always need a plane to hear a sonic boom. The crack of a whip, the tip of which can travel faster than sound, is really a tiny sonic boom. ■

I ALWAYS WONDERED HOW TIME RUNS PERFECTLY IN A COMPUTER EVEN AFTER IT IS SWITCHED OFF?

- Revanth Kausikan

How is that possible with no electricity and internet? Sounds amazing, isn't it?

It's not as amazing as it seems, actually. Computers gather their time from a clock inside the system. This clock is powered by a source of electricity inside the computer - either a battery, or a device such as a capacitor that can store charge.

In older computers, you could simply remove a tiny cell and stop this clock. These days, the cells are often firmly welded to their contacts so that people who want to disturb the computer can't do so easily! ■

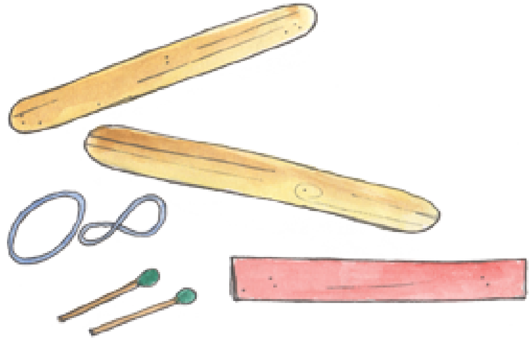
Have a burning question? Email us at *brainwave@ack-media.com* with 'Ask Us Why' as the subject. The best question gets published and wins a cool Amar Chitra Katha comic!

Blow Your Whistle

by **Kayomarz Bacha**

You will need:

- 2 ice cream sticks
- A strip of paper
- 2 matchsticks or toothpicks
- 2 rubber bands



Method:

Step 1

Place the ice cream stick on any table or flat surface.

Step 2

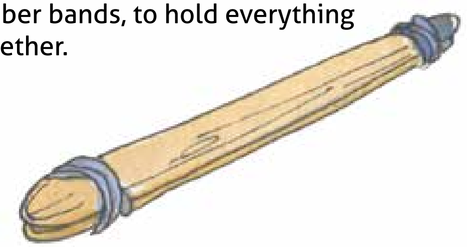
Place the strip of paper on the ice cream stick.

Step 3

Place the other ice cream stick on top of the piece of paper.

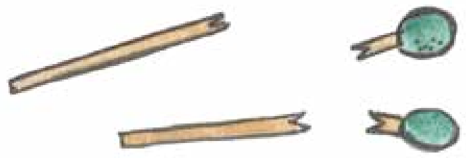
Step 4

Tie both ends of this model with rubber bands, to hold everything together.



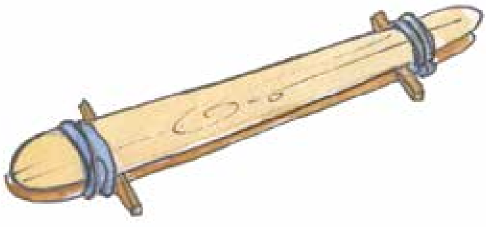
Step 5

Break off the tips of both matchsticks.



Step 6

Insert the matchsticks between the 2 ice cream sticks, creating a small gap.

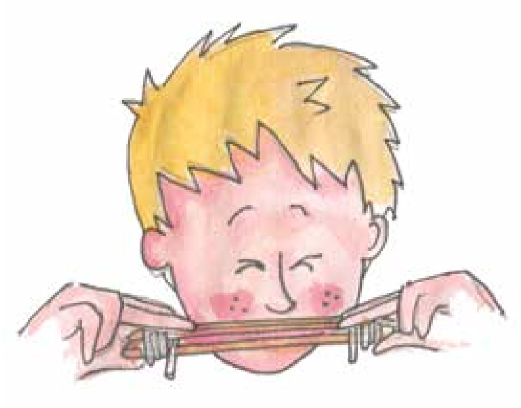


Artwork: Sarthak Sinha

Watch the video at: *www.youtube.com/watch?v=bxOc_wT4ggw*

Step 7

Place the model in your mouth as shown and blow hard.



A very easy, fun and noisy whistle is ready. Have fun!

Why does this happen?

The model we just created acts as a whistle because of the strip of paper between the ice cream sticks.

When you blow air, this strip of paper resonates and vibrates, slapping the two ice cream sticks repeatedly. This is what causes the whistling sound. The force or pressure applied while blowing air is of significance. If you blow slowly, the whistling sound is not heard.

The same principle is used in a harmonica. Blowing air into it makes a set of pre-tuned springs inside vibrate and cause a sound of a particular frequency. Sound is emitted even when you suck air in. ■

What are pitch, frequency and amplitude? Research and email your answers to *brainwave@ack-media.com.* The best answer wins two cool ACK comic books!

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Rangeela Tempera Colours
is available now with

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To celebrate this, **Hobby Ideas** is giving away amazing hampers!
All you have to do to win this hamper is answer the question below:

Q Out of these, which animals have the ability to communicate via ultrasounds?

BRAINWAVE

1

BATS

2

HORSES

3

DOLPHINS

4

ZEBRAS

5

DOGS

6

SLOTHS

7

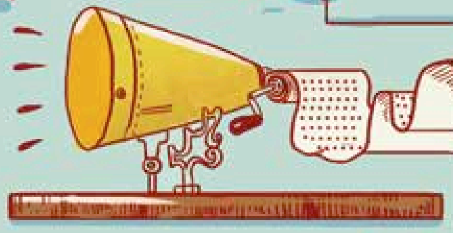
DONKEYS

Send your answers to
brainwave@ack-media.com
& for all you know,
the hamper will arrive right
at your doorstep!

The Evolution of Sound Technology

Written By Sasikanth C   Artwork By Parvati Pillai

There is more to sound recording than just recording sound. Let us explore how technology hasencouraged new ways of listening to sound and music, led the industry to change their practices, and allowed entirely new musical genres to come into existence.



The first recording devices were scientific instruments used to capture and study sound waves. The most famous were the phonautograph by Leon Scott in 1857 and the phonograph by Thomas Edison in 1878.

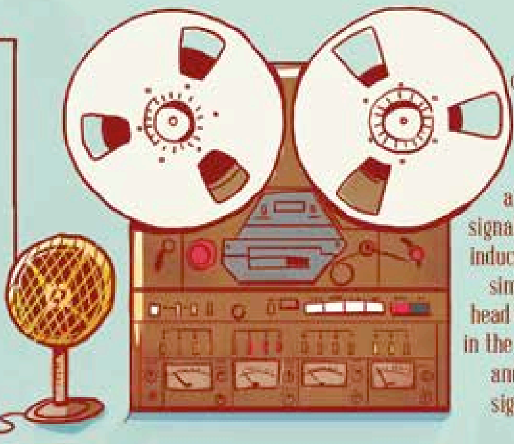
In these devices, styluses etched grooves on rotating cylinders wrapped in impressionable material such as tin foil, or wax. The depth of the grooves made by the stylus corresponded to change in air pressure or vibrations created by the original sound. Recordings could be played back by tracing a needle through the groove and amplifying the resulting vibrations through mechanical means.

However, phonograph cylinders could not be mass produced. Only about 25 copies could be made - all of lower quality than the original - while simultaneously destroying the original. So, performers were booked for marathon sessions - to repeat their performances over and over again, so that multiple originals could be recorded.

This changed with the advent of the gramophone, which was patented by Emile Berliner in 1887. The gramophone imprinted grooves on a disc rather than on the outside of a cylinder. Instead of recording by varying the depth of the groove, the vibration of the recording stylus was across the width of the track.

Phonograph cylinders and gramophone discs were played on mechanical devices that were hand wound. The sound was amplified by a cone that was attached to the diaphragm.

The advent of electrical recording in 1925 drastically improved the quality of the process. Using microphones to capture sound became a possibility. Electrical recording also increased the flexibility of the process. However, the performance was still cut directly to the recording medium, so if a mistake was made, the recording was useless.



Then, magnetic recording came into being. This involved the use of a magnetisable medium which moves with a constant speed past a recording head. An electrical signal is fed to the recording head, inducing a pattern of magnetization similar to the signal. A playback head can then pick up the changes in the magnetic field from the tape and convert it into an electrical signal. Magnetic recording made multitrack recording possible.

Have you ever seen or used an audio or video cassette? If not, go buy one and check it out before they disappear from the markets altogether!

Soon, technologies that optically recorded soundtracks directly onto the side of the strip of motion picture films were developed. This was the dominant technology from the 1930s through the 1960s, and is still in use. Optical soundtracks are visual renditions of sound wave forms and provide sound through a light beam and optical sensor within the projector.

Now is the era of digital recording in which digital audio and video are directly recorded onto a storage device as a stream of discrete numbers, representing the changes in air pressure for audio, and chroma and luminance values for video through time, making an abstract template for the original sound or moving image.

Today, we can record, reproduce and playback sound using our computers and smartphones. Not just that, we can create our own sounds and music usin

THE END.

You can stop using your eyes, mouth and nose using your body's internal mechanism. But, you have no internal mechanism to stop hearing. You can't shut out sound automatically!

The human ear cannot hear frequencies below 20 Hz (infrasonic) and above 20 kHz (ultrasonic waves).
It is most sensitive to frequencies between 500 Hz and 4000 Hz.

WHAT WAS That? Speak at 500 Hz please!

Arthur Perce in 1901 discovered that we cannot identify the direction of sounds when the source is equidistant from both ears. Sound is actually nothing but vibrations travelling through air.

Artwork: Alicia Souza

Here's why fingernails scraping blackboards sound so awful!

For a very long time scientists have been trying to find out why humans find sounds such as the nail-on-blackboard so unbearable to hear. Now, they might have found the answer.

A research led by Michael Oehler from Germany showed that the nail-on-board sound and the cry of a human baby fall within the most sensitive range of human hearing - 2,000 Hz to 4,000 Hz.

It is believed that our ears have 'evolved' to amplify sounds within this frequency. It could have been advantageous for survival, allowing adults to come to the rescue of screaming infants quicker. It could also have helped humans coordinate a hunt more effectively.

Other sounds that cause us discomfort are squeaking polystyrene and a piece of chalk running against a slate. ■

Image Source: Wikimedia Commons

A computerized composition

A computer program will now compose music by monitoring a person's emotional response to sounds!

Led by Dr. Eduardo Miranda and Dr. Slawomir Nasuto, this project begins the process of developing music by playing a composition while the subjects who are listening undergo an MRI scan. During this scan, the computer monitors their brain for emotional indicators and responses to the music piece. Using ☞ artificial intelligence, the mechanical songsmith then produces a rhythm of its own, keeping emotional responses in mind.

Dr. Miranda believes that the program has potential therapeutic applications and could be used to treat depression without resorting to medicines.

Another commercial use of this program is that it could be used in the entertainment industry and in advertising by inducing a desired emotion when presented along with a particular product or service. ■

The world now has a hypersonic plane

X-51 WaveRider, an experimental unmanned scramjet[G] developed for the US Air Force went hypersonic as it flew five times the speed of sound for three minutes.

The WaveRider reached a speed of 5,400 kmph, resulting in the longest air-breathing[G] hypersonic flight. The flight ended with a planned plunge into the Pacific Ocean.

With the help of aircrafts like the X-51, the US Air Force plans on studying the scramjet technology so that it can be used to make commercial flights around the globe within minutes. So far, the air force has spent $300 million on studying this technology. ■

A Sound Celeb

A tribute to an Indian who made sure India left its mark in the world of Sound.

by **Priyanka Talreja**

Image Source: Wikimedia Commons

Amar Bose was an Indian American academician and entrepreneur. An electrical and sound engineer, he was a professor at Massachusetts Institute of Technology (MIT) for over 45 years. He was also the founder and chairman of Bose Corporation. In 2007, he was listed in Forbes 400 as the 271st richest man in the world, with a net worth of $1.8 billion.

For his schooling, Bose went to Abington Senior High School in Pennsylvania and then enrolled at the Massachusetts Institute of Technology. Here, in the early 1950s, he graduated with a BS (Bachelor of Science) in Electrical Engineering.

After graduation, Bose became an Assistant Professor at the Massachusetts Institute of Technology. One day in 1956, as a professor, Bose purchased a high-end stereo speaker system. On using it, Bose was disappointed to find that the speakers with impressive technical specifications failed to reproduce the realism of a live performance.

Soon, Bose began a research concentrating on the key weaknesses of the high-end speaker systems available at the time. His research led him to invent a stereo loudspeaker that would reproduce realistic sound.

In 1964, Bose started his own company - Bose Corporation. He was awarded significant ☞ patents^{G}, propelling his dreams further. Today Bose Corporation has 9,000+ employees worldwide and builds products for home, car, and professional audio, and conducts basic research in acoustics and other fields.

Bose once said, "I would have been fired a hundred times at a company run by MBAs. But, I never went into business to make money. I wanted to do interesting things that hadn't been done before." ■

A tribute to Bose: www.youtube.com/watch?v=h4KHHcCo3lw

The Curious Case of the Disappearing Noise

by **Joanne Carlo**

Artwork: Sarthak Sinha

The Curious Case of the Disappearing Noise

Jason and Susie are determined to find out where sound keeps disappearing to. Will they solve the mystery?

Jason was a terror. Nicknamed the Jonster, he would bully his parents, teachers and classmates tirelessly. But as much as this 8-year-old body hated studying, his curiosity mostly got the better of him. He would bravely collect worms, grasshoppers and frogs just to get a closer look at them. Nothing scared him. A Jonster they might call him, but Jason knew he was Jason-the-Brave.

"Jason look out!" yelled Susie.

Brave Jason was so lost in his world, he almost fell into a newly dug hole on the road. "What on Earth ... Why is there a hole in the middle of the road?" grumbled Jason.

"Well, maybe if you looked at what's in front of you while walking, you would know," shot back Susie. "Can't you see they are drilling holes in the road? Or have you gone blind?"

Jason glared at his geeky classmate Susie. "Who do you..." but Jason's voice drowned in a terrible noise that went DR-R-R-R-R-R!

A man with a big moustache, who was until then munching away on his sandwich, just got back to his work. With a huge electric drill, he began to smash up the tarred surface. The noise was so deafening that both Susie and Jason, hands covering their ears, had to run away from it as fast as they could!

As they got further away, the sound became quieter and quieter, until finally, Jason and Susie couldn't hear it at all.

"What?" asked Jason, "is that sound? It's very irritating."

"If you had paid some attention in science class on Monday, you would know," replied Susie.

"When something moves back and forth very quickly, like the drill that guy was using, vibrations are formed. These vibrations move through air, out and away from the drill. Eventually, they reach our ears and we hear them as sound," explained Susie.

"Huh? Then where did the sound go? We've just reached the end of the road. How come we can't hear it anymore?"

"Gosh, don't you know anything?" exclaimed Smarty-pants Susie. Actually, she didn't know the answer to Jason's question and the only way she could get away with not knowing, was by being very rude.

Before the ever-curious Jason could ask any more questions, Susie spotted her house in the distance and sprinted towards it at top speed.

"Weirdo!" thought Jason.

As Jason reached home, he felt the need to solve the mystery of the disappearing noise. How could it just vanish?

He switched on his computer that his mom had just got him; legs dangling off the edge of his chair, he googled "sound". Hundreds of results popped up.

Jason clicked on the first link – and minutes later, he was lost in the world of sound.

……

The next day, as Jason was walking to school,

he saw Susie. "Hey!" he called out. "Did you find out where the sound from the drill disappeared yesterday?"

Susie tried to ignore him. As soon as she had reached home, she had forgotten all about Jason, drills and sounds. But she wasn't going to admit that. Not to him!

Not getting the hint, Jason pushed on, "I found out, you want to know?"

"I already know," said Susie with false confidence, "but you can always refresh my memory."

"Sure!" Jason smirked; he knew Susie's looks only too well.

"It's like the waves that form when you throw a stone into a still pond," explained Jason. "The sound waves from the drill spread out in all directions just like the waves in the water spread out in all directions."

"That makes no sense," said Susie, "Are you saying that the air moved into my ear and I heard the sound?"

"Kind of!" said Jason, "Though, it's the waves that move, not the air itself. Hence the sound waves are strongest at the place where they are made. But as we moved away from the drill, the noise became softer."

"Is this theory applicable to all kinds of sounds?" asked Susie, forgetting all about her resolve to not let Jason know that she did not know about this topic.

"Of course!" scorned Jason, "The zzzzeeee of a mosquito and the vrooooomm of a tractor - they might all be different sounds. But, it all comes down to vibrations that you were babbling about yesterday, remember?"

"The faster something vibrates, the more waves it makes and hence, more sound. Mosquitos' wings vibrate quickly, that's why we hear a high-pitched zzzzeeee. Whereas the tractor moves slowly, so it makes a low-pitched vrooooomm."

"But, what is 'pitch'?" asked Susie, puzzled.

"Well ... to understand pitch, you need to understand frequency first," replied Jason. "Frequency is the number of times a sound wave vibrates each second. The pitch of the sound is our ears' response to the frequency of the sound."

"Wow, though you did not pay attention when Miss Betty taught the subject, you researched well, did you not?" said Susie. "But I'm sure you didn't read this – animals can make and hear sounds that people can't hear at all?"

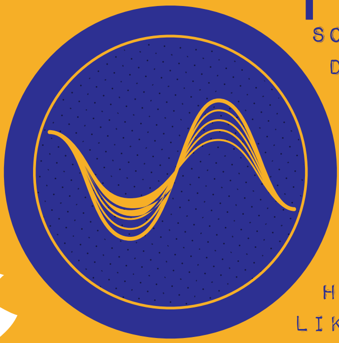
"Of course, silly!" Jason laughed. "Whales sing to each other when they are hundreds of kilometres apart in the depths of the oceans. We humans can only hear it through special machines."

"Oh, I didn't know that," conceded Susie. "Speaking of singing, do you know what's the difference between music and noise?"

"Well ... well ..." muttered Jason, under his breath.

"I will tell you," exclaimed Susie. "It all comes down to sound, just that it is a different type. Music combines specific frequencies harmonically. Noise, on the other hand, is a harsher combination of frequencies."

"Wow, that's something I didn't read about when researching last night," murmured Jason. "Maybe you deserve the nickname Smarty-pants Susie after all!" ■



Hi!

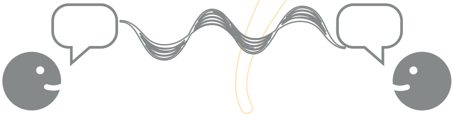
I AM A SOUND WAVE. I DON'T MAKE PUBLIC APPEARANCES OFTEN. I AM, WELL ... THE SHY KIND. BUT NOW THAT I AM HERE, I WOULD LIKE TO TELL YOU A LITTLE ABOUT MYSELF. LET'S BEGIN WITH MY NATURE.

[BY NATURE, I AM A **MECHAN**
WAVE. THIS MEANS THAT TO
ONE PLACE TO ANOTHER, I NEE
OF A MEDIUM. WHICHEVER MEDI
ON IS KNOWN AS THE **SOUND**
THESE MEDIUMS ARE MAINLY **S**
LIQUIDS + GASES. BUT
AT WHICH I TRAVEL THROUGH E
THESE VARIES.

did you know?

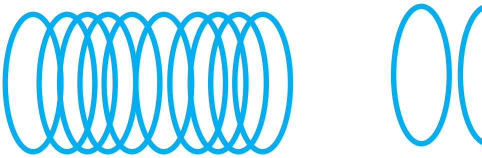
IF YOU PLACE ME IN A VACUUM, I WON'T BE ABLE TO TRAVEL. THIS IS WHY I NEVER GO TO OUTER SPACE. THERE ARE NO SOUND MEDIUMS THERE. I ALSO HATE TO BE TRAPPED IN A JAR.

A NORMAL HUMAN CONVERSATION TAKES PLACE AT ABOUT 60 DECIBLES!

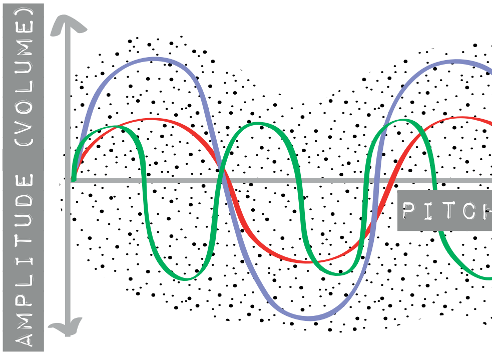


HUMANS CAN HEAR SOUNDS BETWEEN 20 TO 20,000 HZ.

1. WHILE MOVING FROM ONE PLACE
I TRAVEL IN A LONGITUDINAL
COMPRESSIONS + **RARE**



2. THE HIGHER I GO IN THIS WAV
SOUND GETS. HUMANS LIKE TO
AMPLITUDE. THIS IS ALSO
MY POWER OR STRENGTH.



LASTLY,
I AM ALSO PRESENT AS :

INFRASONIC >

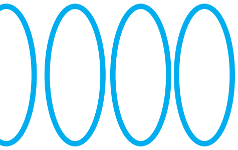
BELOW THE AUDIBLE
FOR HUMANS. ELEPHA
AS LOW AS 14 HZ.

ICAL

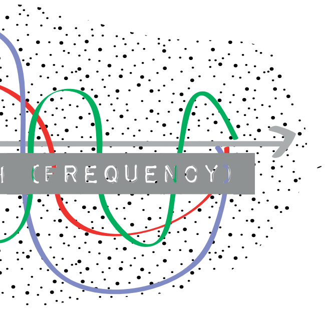
MOVE FROM
D THE HELP
UM I RIDE
MEDIUM.
OLIDS.

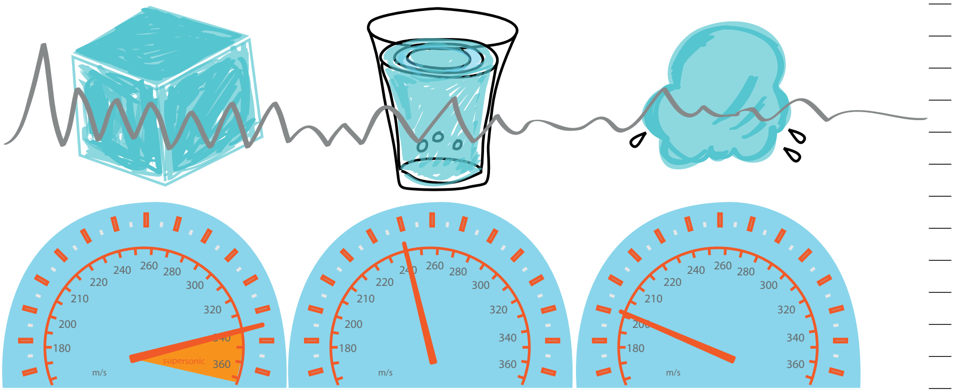
T THE SPEED
EACH OF]

TO ANOTHER,
MANNER THROUGH
FACTIONS.



E, THE LOUDER THE
CALL MY HEIGHT
THE MEASURE OF





I CAN TRAVEL THE FASTEST THROUGH SOLIDS BECAUSE THE MOLECULES ARE VERY CLOSELY PACKED. I GET SLOWER IN LIQUIDS AND AM THE SLOWEST IN GASES.

3. ANOTHER INTERESTING THING ABOUT ME IS MY **PITCH**. PITCH IS THE RATE AT WHICH VIBRATIONS ARE PRODUCED PER SECOND.

HIGHER THE PITCH, SHARPER THE SOUND GETS.

4. THIS IS USUALLY EXPRESSED AS THE **NUMBER OF HZ** (HERTZ), OR CYCLES PER SECOND. HZ IS THEN MEASURED AS THE FREQUENCY OF THE TONE. THE HIGHER THE FREQUENCY OF A TONE, THE HIGHER ITS PITCH.

5. MY LOUDNESS OR INTENSITY CAN BE MEASURED IN **DECIBELS (DB)**

Artwork: Ria Rajan

20 HZ

SOUND FREQUENCIES
NTS HEAR FREQUENCIES

ULTRASONIC > 20K HZ

ABOVE THE AUDIBLE SOUND FREQUENCIES FOR HUMANS, BATS AND DOLPHINS HEAR FREQUENCIES AS HIGH AS 2,000-110,000 HZ.

From Bones to Phones

by **Pushkar Samant**

Image Source: Wikimedia Commons

Neolithic bone flute

Can your ears remind you of a day when they did not listen to a single musical tune? Let it be a bird's chirp or a cool animation on TV, we keep listening to various sounds that are musical.

Yet, can you guess what the first ever musical instrument was? Well, it's a flute made from bones of vulture's wings!

In ancient days, musical instruments were used for rituals. Of course, there is a lot of dispute amongst researchers about when humans started creating music. However, we can safely say that music is as old as humankind itself.

The first flutes were made in India out of wood around 5000 BC. Then, around 300 BC, string instruments came into being followed by orchestra in 619 AD in China.

With developing cultures, music evolved too. By 1025 AD, polyphonic music[G], musical scores and notes were invented. A1000 years ago, the discovery of various metals lead to the invention of instruments such as bells. It also changed the way string instruments were made. The piano, made around 1700 years ago is an example.

Various instruments attracted societies around the world to music. Technology helped take this a step ahead. In 1919, the first electronic music instrument, Theremin[G], came into being. The year 1932 gifted us an electric guitar. By 1957, computer assisted musical compositions were invented.

Today, music is just a touch away. We have ☞developed software and mobile apps that can play music like any instrument, even from our smartphones! ■

CAN YOU HEAR ME?

by **Pushkar Samant**

On one of the days during Diwali, Alby was walking down a street, when suddenly, a firecracker burst out near him. Momentarily startled, he recovered, but his ears felt a little numb. Though he was able to hear voices around him, he felt as if they were from far away.

After struggling with his hearing for a while, Alby went straight away to see Dr. Dodo.

“Dr. Dodo, please see what's wrong with my ears. I can’t hear properly,” Alby complained.

“It's Diwali time. I guess it's because of firecrackers. Did a firecracker blow up near you?” Dr. Dodo asked calmly.

“Yes! How could you guess?” Alby asked, surprised.

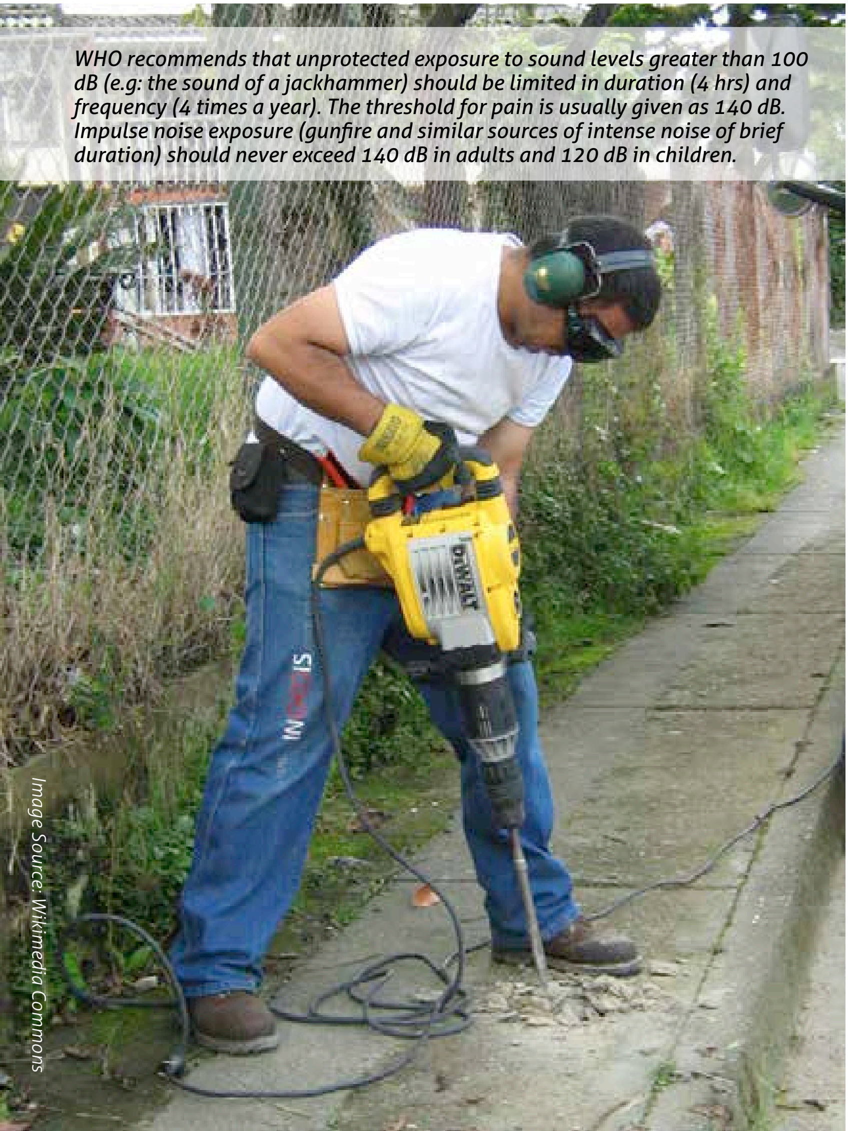
“It happens when your ears are exposed to loud noises such as sound from firecrackers,” Dr. Dodo explained, while examining Alby’s ears. “It's called noise-induced hearing loss. It can be temporary or permanent.”

“You mean I have lost my hearing?” Alby shrieked, scared.

“No. But you could have. Harmful noises - explosions, music concerts, video games with loud music, etc. - are dangerous for our ears,” Dr. Dodo elaborated, while dropping some magic potion into Alby’s ears. “They affect the sensitive structures in our inner ear, causing noise-induced hearing loss.”

“But then, how can we prevent it?” a curious Alby asked.

“Use of earplugs and earmuffs is the easy way out. However, reducing noise pollution is the best way forward. But, I guess it is tough for humans to do that,” said Dr. Dodo sadly, and went back to his work. ■



WHO recommends that unprotected exposure to sound levels greater than 100 dB (e.g: the sound of a jackhammer) should be limited in duration (4 hrs) and frequency (4 times a year). The threshold for pain is usually given as 140 dB. Impulse noise exposure (gunfire and similar sources of intense noise of brief duration) should never exceed 140 dB in adults and 120 dB in children.

Image Source: Wikimedia Commons

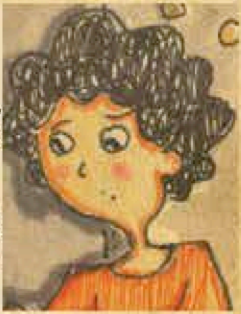
THE TIME TRAVELLING KUMARS

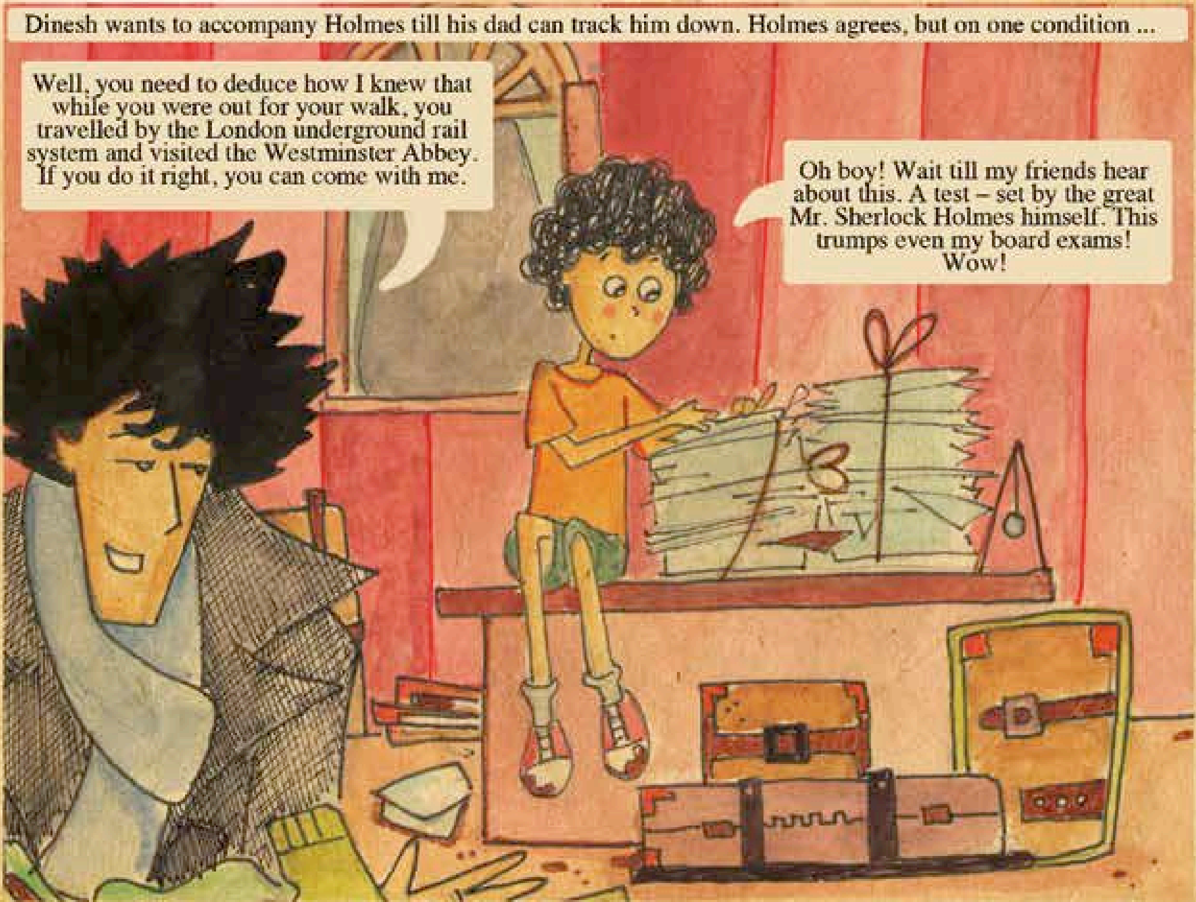
Sherlock Diaries

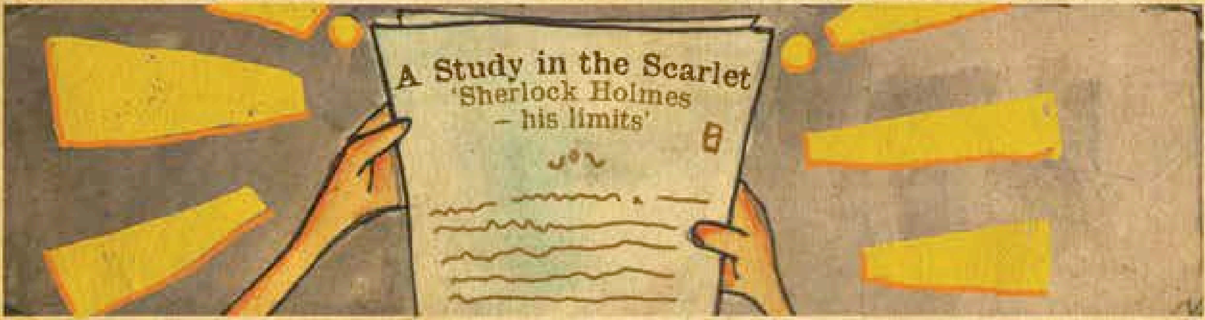
5

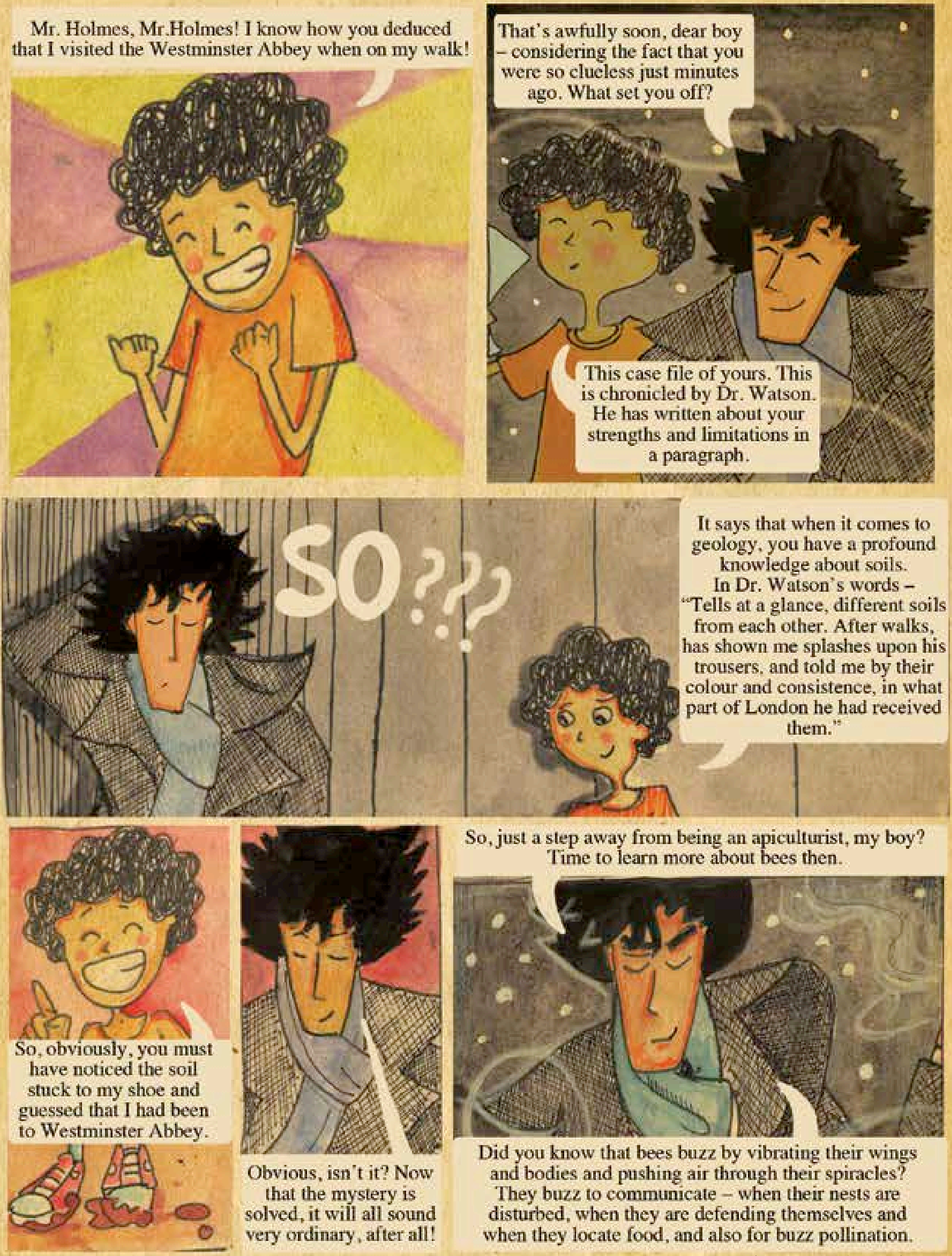
Story by:
Sasikanth.C
Artwork by:
Sarthak Sinha

In the previous issues, we have seen Dinesh get separated from his parents during their time travelling adventures and land in the early 20th century London, meeting Sherlock Holmes in 221B Baker Street.
A couple of discussions and a case later, Dinesh is shocked to know that Holmes is planning to retire to bee-keeping in Sussex Downs!

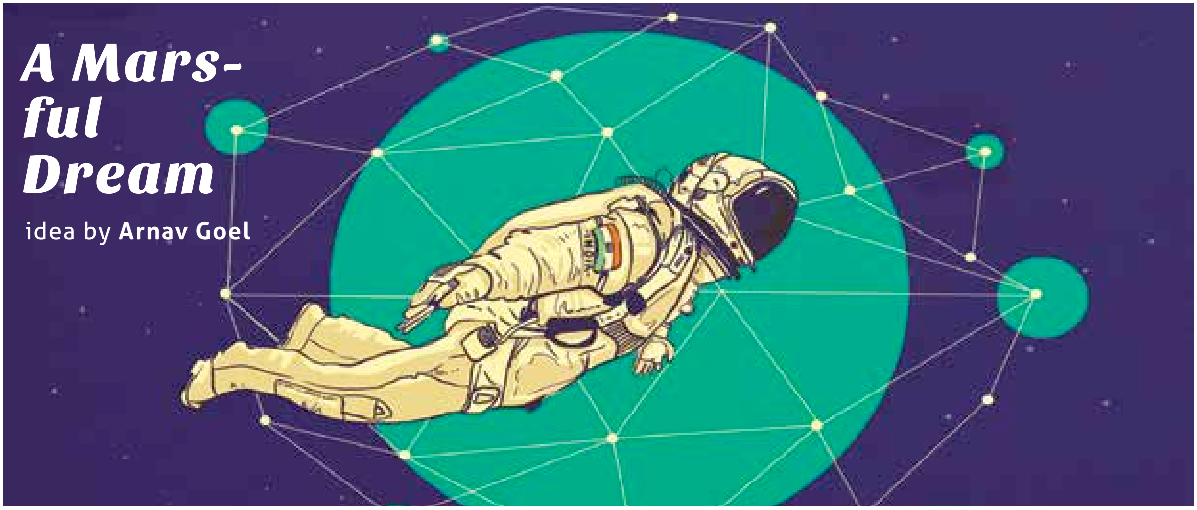



Dinesh wants to accompany Holmes till his dad can track him down. Holmes agrees, but on one condition ...
Well, you need to deduce how I knew that while you were out for your walk, you travelled by the London underground rail system and visited the Westminster Abbey. If you do it right, you can come with me.
Oh boy! Wait till my friends hear about this. A test – set by the great Mr. Sherlock Holmes himself. This trumps even my board exams! Wow!




Mr. Holmes, Mr.Holmes! I know how you deduced that I visited the Westminster Abbey when on my walk!
That's awfully soon, dear boy – considering the fact that you were so clueless just minutes ago. What set you off?
This case file of yours. This is chronicled by Dr. Watson. He has written about your strengths and limitations in a paragraph.
SO???
It says that when it comes to geology, you have a profound knowledge about soils. In Dr. Watson's words – "Tells at a glance, different soils from each other. After walks, has shown me splashes upon his trousers, and told me by their colour and consistence, in what part of London he had received them."
So, obviously, you must have noticed the soil stuck to my shoe and guessed that I had been to Westminster Abbey.
Obvious, isn't it? Now that the mystery is solved, it will all sound very ordinary, after all!
So, just a step away from being an apiculturist, my boy? Time to learn more about bees then.
Did you know that bees buzz by vibrating their wings and bodies and pushing air through their spiracles? They buzz to communicate – when their nests are disturbed, when they are defending themselves and when they locate food, and also for buzz pollination.

to be continued...



A Mars-ful Dream

idea by **Arnav Goel**

Artwork: Parvati Pillai

Can dreams turn into reality? Because if they can, I'd love for my last dream to come true! Let me warn you, it was a very strange dream. I saw that the first manned mission to Mars had been declared and it was an initiative by India. The name of this mission was Bhaskara V.

I was chosen as a senior astronaut for the mission. My colleagues were from the across the world - US, China, Russia, Korea and Germany. On 11th February 2120, we took off.

Our journey was streamed live to every home back on the Earth. It lasted 25 days, as opposed to the 2012 Curiosity Lander's journey of 253 days. We could speed up our journey because we used the minimum energy transfer orbit method to travel. The cosmic fuel gave the rocket immense power and speed – 10 times more than regular rocket fuels.

Since Mars is filled with CO2, we had to solely depend on our oxygen banks. The temperatures varied from -153°Celsius at the poles to 20°Celsius at the equator, during summers. The pressure was 50 times less than that on the Earth. There were frequent dust storms and CO2 snowfalls. We had to use our vacuum suits made of plutonium and be very careful.

Each day on Mars was 24 hours, 39 minutes. But the year would last for almost 687 days. So, though we were 30 years old on the Earth, we were only 16 on Mars! We saw two moons in the sky, and visited the Olympus Mons, the tallest mountain in our Solar System. We recorded our experiences into the super computer at ISRO, telepathically.

One day, we chanced upon some structures that looked like prehistoric caves humans lived in! We were excited and frightened at the same time. Alien life? Carefully, we armed ourselves with the latest Gray-UVX shooters and stepped in. Suddenly, piercing shrieks caught me off guard. That was when I woke up with a sudden start, sweating. It was my dad yelling at me to get out of bed and study - a sad end to an exciting Mars-ful dream! ■

Write an epic science fiction story in not less than 150 words and email it to us at brainwave@ack-media.com. 2 best entries get to win 2 *EPIC* DVDs from 20th Century Fox and Excel Home Entertainment.

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DVD's and Blu Rays now in stores

SOLUTIONS AND WINNERS

Winners of various activities in the August 2013 issue are:
Toy Box: Srinidhi Radhakrishnan
Ask Us Why: Prathul Venkatesh
Arby Files: Diya Aravind
Fan Fiction: Athul Vijay
Third Law: Suraj Krishnan
Planet Ninjas: Suyash Jaju
Eye See: Sabarish Iyer
DIY: Shreyas Minocha
Spot the Errors: Aniket Allakky
Fun-do Band: No one
Treasure Hunt: Rohit B & Mehnaz Yunus
Magic Science: Dishita Ashar

Pokemon Contest: Dev Shroff, Jemin M Mehta, Tvesa, Saiswetha and Pruthvi Bhat

Suyash Jaju gets nominated for the BW Student Board. For more details, visit
www.bwmag.in/student-board

The BW Smartenstein title, certificate and mystery gift for March go to Srinidhi Radhakrishnan. For more details, visit -
www.bwmag.in/category/bw-smartenstein

September 2013 winners will be declared in the November 2013 issue.

Letters from Readers

This is the first time I am reading Brainwave and I think it is a great magazine that can help us get intersted in all the subjects of science. I have learnt a lot from the first issue and I will continue to learn more.
Harshvardhan Sahay, via email

Dear Harsh,
We are glad to receive your email. We look forward to receiving more reviews and some specific feedback about our upcoming issues from you!
SK, Editor

Brainwave is a very interesting magazine and I look forward to my copy every month. In my opinion, I think you should discontinue the 'spot the errors' contest and bring back 'Sci-Q Time' as it helps us review what we learnt in the issue. Errors should be minimized no matter how small. Could you also please bring back the crossword?
Mehnaz Yunus, Via email

Dear Mehnaz,
Great suggestions. Thank you. The purpose of 'spot the errors' is to encourage students who are afraid of or hate science, to read through the magazine. But, we shall positively discuss your suggestions (including the ones about Sci-Q Time and crossword) in our next team brainstorming session and do the needful.
SK, Editor

I am a regular reader of Brainwave. I have all the issues of Brainwave in my collection right from the very first issue.The only issue I don't have is December 2011. Hats off to the illustrations by Abhijeet Kini in THE SMARTIES comic. Keep it up, Brainwave team!!
Vaman Neurekar, via email

Dear Vaman,
Unfortunately, our stocks of all previous print issues are exhausted. But, we can send a soft copy to you if you could email us your subscription number.
SK, Editor

Pit-Pat-Plock

by **Priyanka Talreja**

This world is full of weird, bizarre people. Some go to the mental asylum while others go viral! Here's the story of the looneys who went viral.

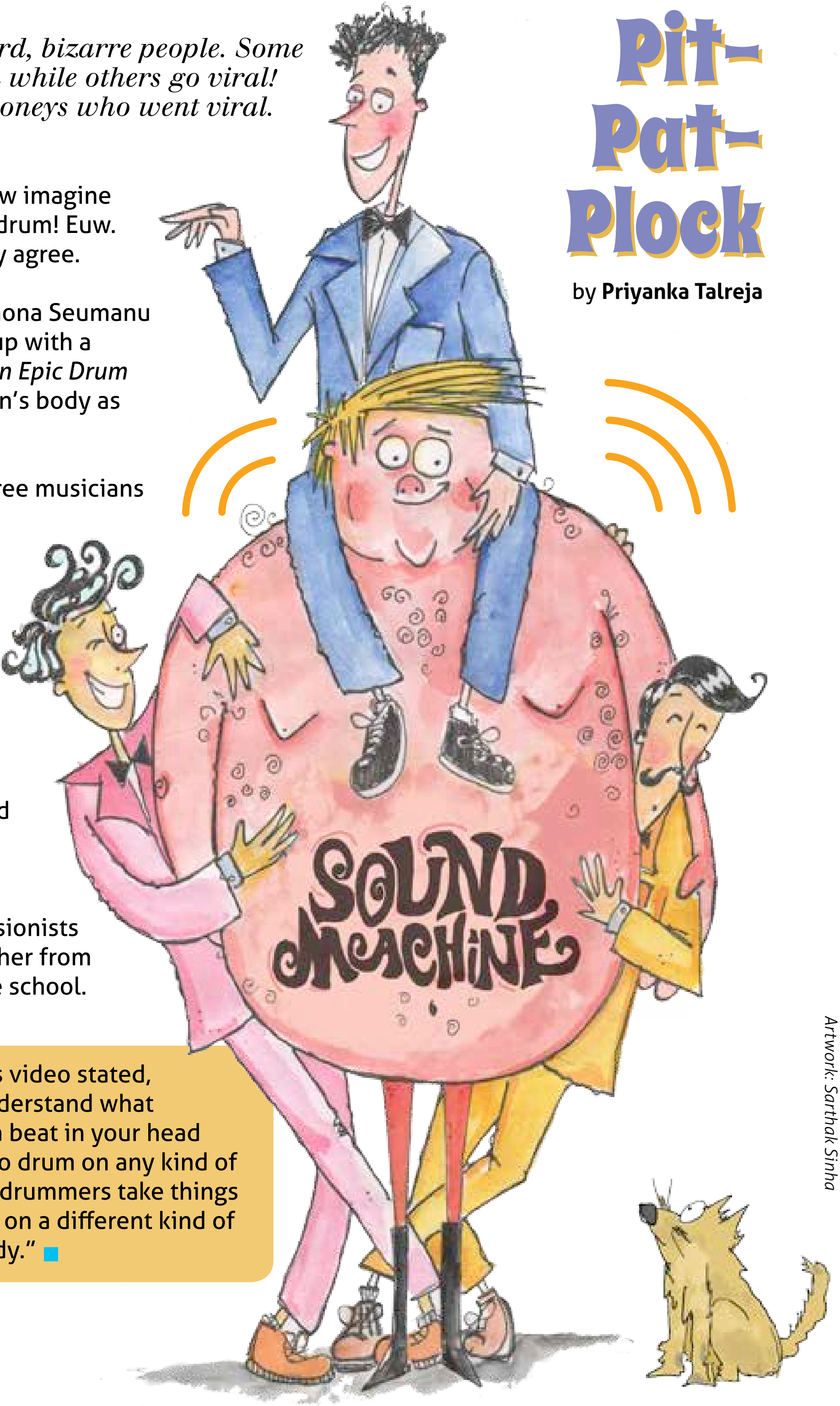
Imagine a really fat guy. Now imagine using his body as a human drum! Euw. Gross, right? We completely agree.

Drummers Matt Nickle, Liahona Seumanu and Tyrell Shepherd came up with a video called, *Tummy Talk: An Epic Drum Solo*, where they used a man's body as their whole drum kit.

In this video, we see the three musicians pound out a rhythm on a man's (called Niu Luamanuvae) upper body. This includes his back, shoulders, stomach and face! Believe it or not, this tummy-tapping adventure has helped the musicians go viral. In just two weeks, this clip earned almost 3 million views, but got mixed reviews.

The video's description indicates that these percussionists have been drumming together from the day they started middle school.

The post that displayed this video stated, "If you like to drum, you understand what it's like to constantly have a beat in your head and always have the need to drum on any kind of object around you ... These drummers take things to the next level by playing on a different kind of instrument - the human body." ■



Artwork: Sarthak Sinha

Sound through mediums

by **Kayomarz Bacha**

Sound can travel through different mediums such as solid, liquid and gas. The sound waves move through different mediums due to vibrations of molecules in the matter.

Knock on a table and listen to the sound.

Now press your ear to the table and knock on it again.

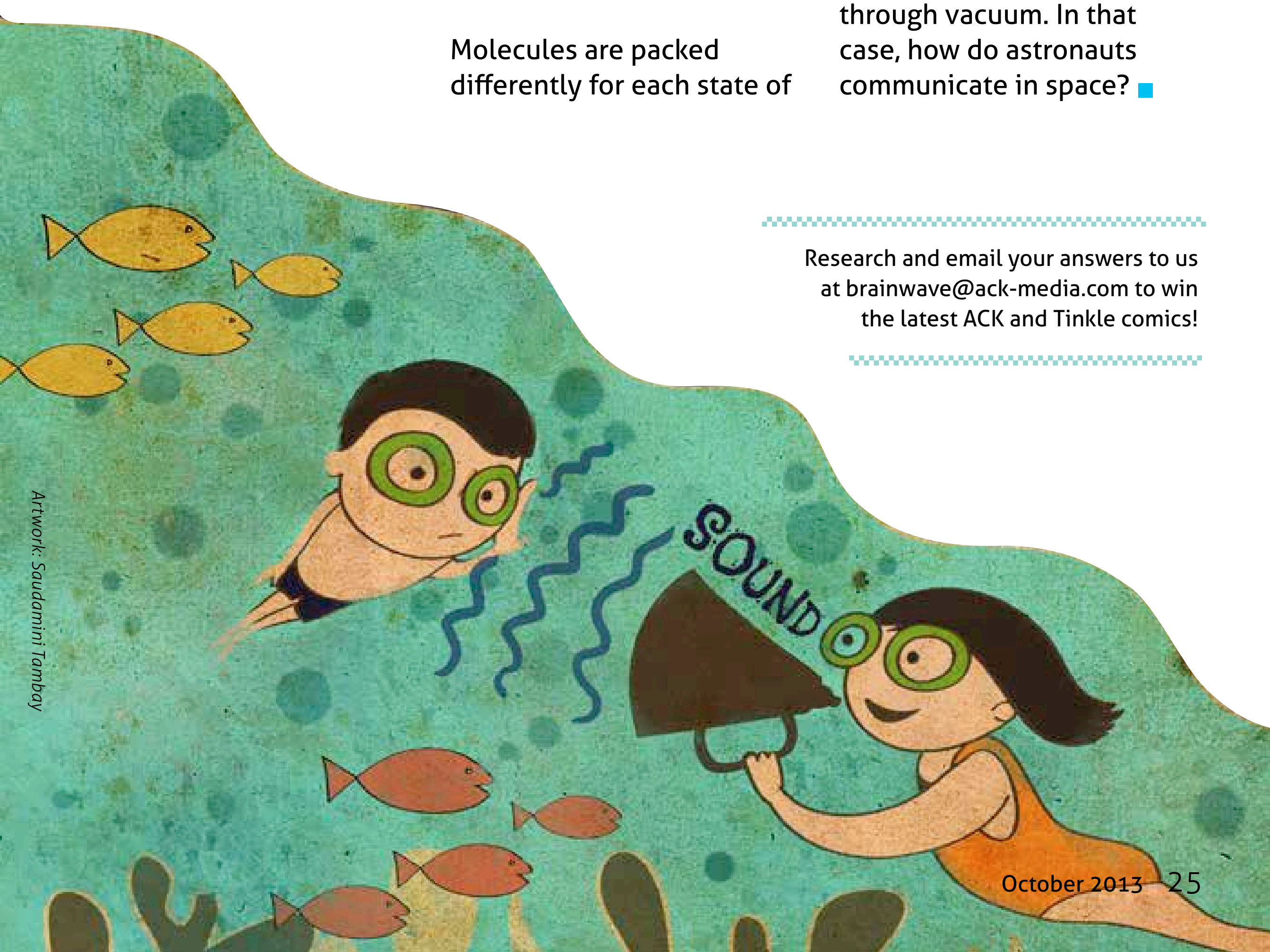
Was there a difference between the two sounds? Was one louder than the other? Why?

Do you think you and your friend can talk to each other underwater?

Molecules are packed differently for each state of matter. Accordingly, sound travels in a different way in each, making it louder or softer depending on the medium.

Tell us how the molecules are packed in each medium and how sound travels in each. Also, it is said that sound does not travel through vacuum. In that case, how do astronauts communicate in space? ■

Research and email your answers to us at brainwave@ack-media.com to win the latest ACK and Tinkle comics!



Artwork: Saudamini Tambay

The BW Student Board members work with our editorial team and make a difference to the magazine.

In addition to this, their work is published in the magazine and they get to lay their hands on all BW products before anyone else - for free!

At the end of their tenure, we award them with certificates and an honorarium of Rs. 1250 each.

For more information, visit:
www.bwmag.in/student-board

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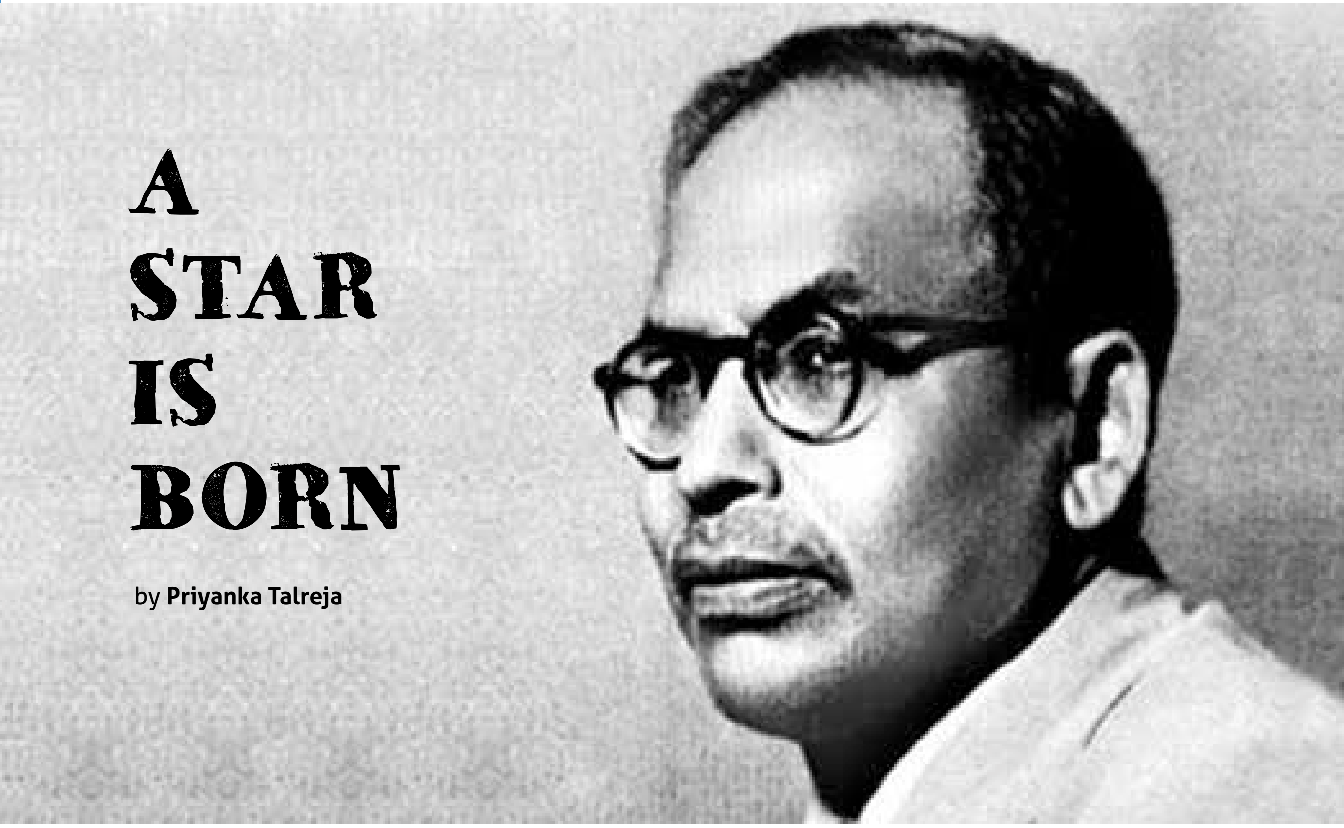
Join us on our Fun-do video channel as *Mr. X* performs some amazing experiments and *X-plains* the science behind them.

Mr. X might perform and publish your experiments too! If published, you will win a surprise gift. Just email your experiment in detail to brainwave@ack-media.com

You Tube

www.youtube.com/Brainwavemag

Artwork: Abhijeet Kini



A STAR IS BORN

by **Priyanka Talreja**

October has been a very eventful month as far as Indian science history is concerned. Let's take our time machine and meet an amazing Indian scientist who left his mark in the world of science.

The Genius - Meghnad Saha

Born on October 6, 1893, Meghnad Saha was an Indian astrophysicist who gave the world his contribution in the form of the Saha equation. He was born in the small village of Shaoratoli near Dhaka. Saha had to struggle a lot in life due to his weak financial background. Yet, he did not let that stop him.

Some of Saha's biggest achievements include:

- Professor at Allahabad University from 1923 to 1938.
- Professor and Dean of the Faculty of Science at the University of Calcutta until his death in 1956.
- Fellow of the Royal Society in 1927.
- President of the 21st session of the Indian Science Congress in 1934.

Image Source: Wikimedia Commons

What is Saha Equation: Gasses at high temperatures have high energy and move at great speeds, colliding with each other. This ionizes[G] some atoms. Saha equation is the mathematical expression that relates this ionization state of an element to the temperature and pressure.

Practical Use: To describe chemical and physical conditions in stars, and analyze the universe better. ■

A Sci-fi-World

by **Priyanka Talreja**

Evolution of AV recording: There are four movie reels here, loaded up with Avatar. The two loaded reels are for Avatar 3D, and the empty ones are for when the movie is done - this is designed so that when the movie is finished, there's no need to rewind the reel at all - it's simply on the secondary reel.

October is a great time to celebrate science across the globe. Let's take a look at some global events we must mark on our calendars.

Sardinia Symposia, a waste management initiative: 30 Sept - 04 Oct

Developed to study waste management, this event rapidly became the reference forum in the field of waste management, on an international level. During this event, state of the art concepts, strategies and technologies are presented and shared by leading ☞ scientists, administrators and practitioners from across the globe.

This year, the Sardinia Symposia will celebrate its 25th anniversary with over 800 delegates from 63 different countries. It will stay focused on the advances of Waste Management science and technology. The attendees will present case studies and discuss key controversial subjects.

The World Day for Audio-visual Heritage: Oct 27

This day is celebrated annually to build global awareness of issues on preserving audio-visual material, such as sound recordings and moving images.

The need for this day was felt as it was observed that many sound recordings, moving images and other audiovisual materials were being lost because of neglect, natural decay or technological obsolescence. This is when organizations such as UNESCO felt that more audiovisual documents would be lost if stronger international action was not taken. The first World Day for Audiovisual Heritage was held on October 27, 2007.

On this day, the United Nations Educational, Scientific and Cultural Organization (UNESCO) works with organizations, governments and communities and organizes activities and events such as:

- Local programs organized as a joint effort between national film archives, audiovisual societies, television or radio stations, and governments.
- Panel discussions, conferences and public talks on the importance of preserving important audiovisual documents.
- Special film screenings. ■

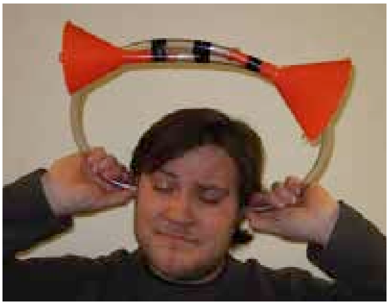
Image Source: Wikimedia Commons

Swapping sounds

by **Kayomarz Bacha**

Attach 2 funnels to 2 pieces of flexible tube or pipe, each of approximately 15 inches in length.

Ask your friend to hold the pieces to his or her ears like in the image here and shut his or her eyes. Then, walk in a circle around the friend, making plenty of noise. See if the friend can identify where you are standing at each point in time.



To everyone's amazement and amusement, your friend will always end up pointing in the opposite direction.

Your brain has various ways of detecting where a sound is coming from, but it primarily uses the fact that you have two ears. Sound travels at about 330 m/s which means that if there is something noisy to your left, the sound will get to your left ear about a 2000th of a second before it arrives at your right ear. This lets your brain calculate and realise that the source of the sound is to your left.

Enjoy fooling your friends and family using this neat trick. Have fun and if you know any such tricks about sound or music, write to us and let us know. ■

Research and email your tricks to brainwave@ack-media.com
The most enthusiastic response can win you a cool gifts worth Rs. 200!

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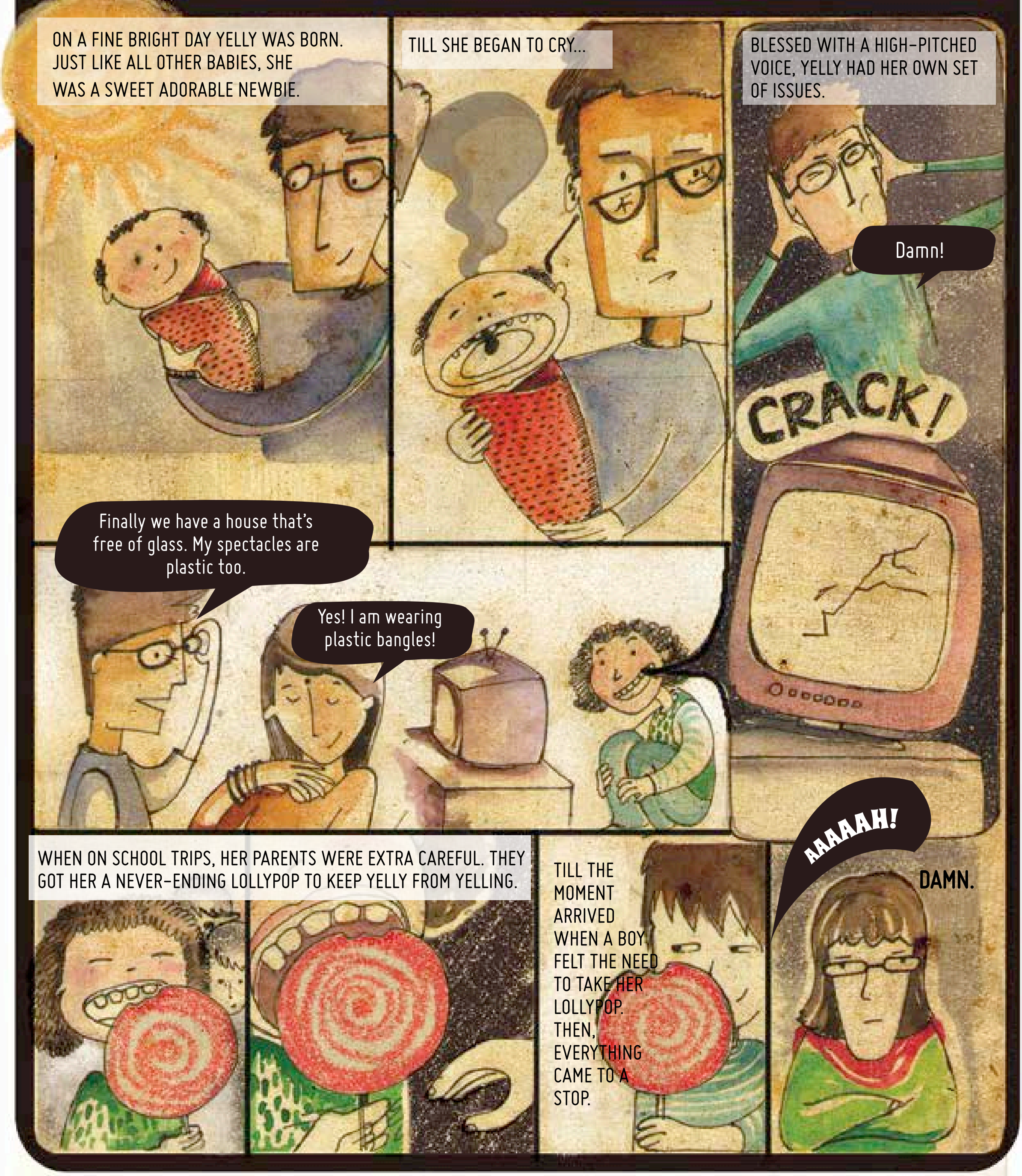
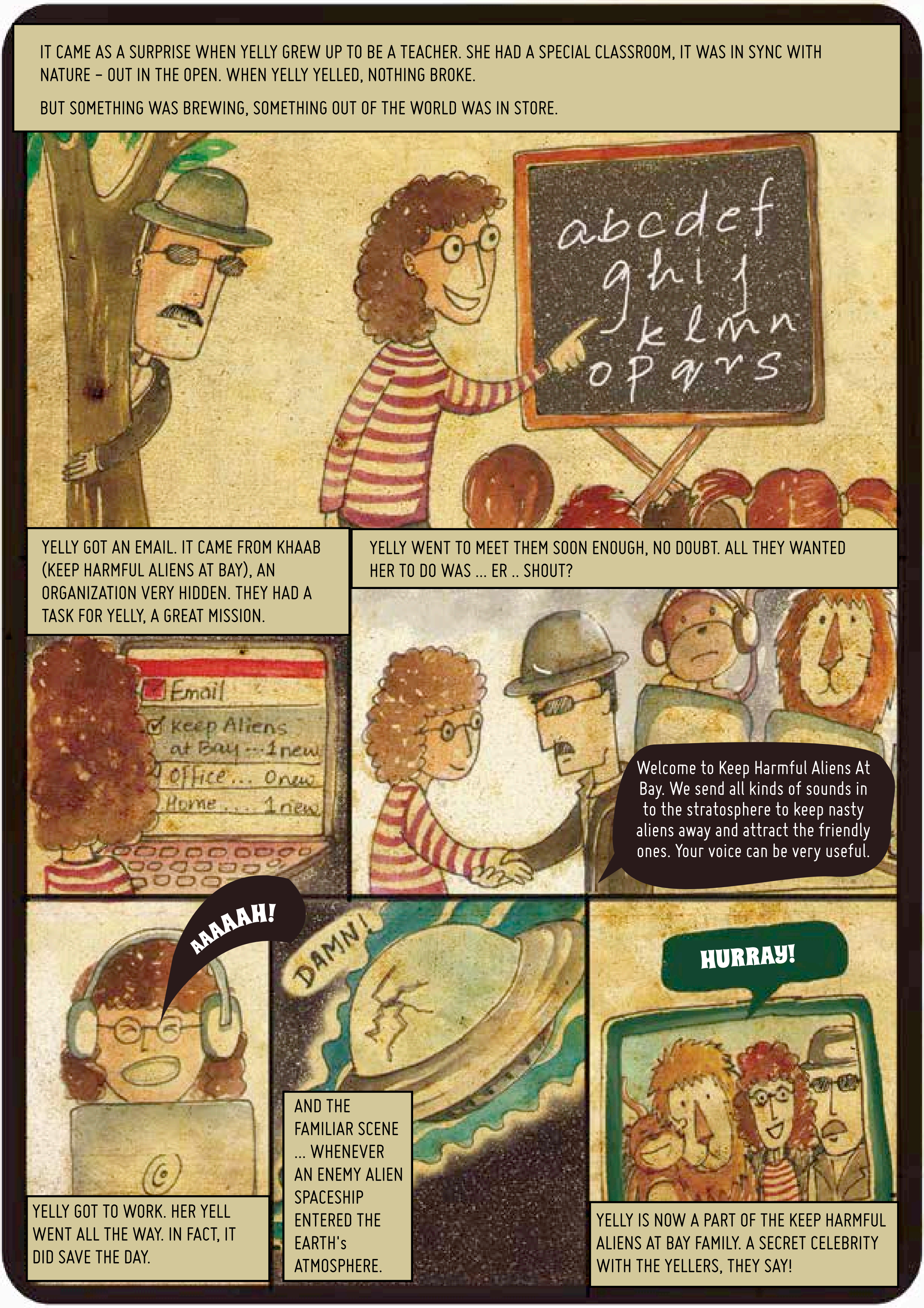
Yelly's Diary

WRITTEN BY: PRIYANKA TALREJA
ARTWORK BY: SAUDAMINI TAMBAY


ON A FINE BRIGHT DAY YELLY WAS BORN. JUST LIKE ALL OTHER BABIES, SHE WAS A SWEET ADORABLE NEWBIE.
TILL SHE BEGAN TO CRY...
BLESSED WITH A HIGH-PITCHED VOICE, YELLY HAD HER OWN SET OF ISSUES.
Damn!
CRACK!
Finally we have a house that's free of glass. My spectacles are plastic too.
Yes! I am wearing plastic bangles!
WHEN ON SCHOOL TRIPS, HER PARENTS WERE EXTRA CAREFUL. THEY GOT HER A NEVER-ENDING LOLLYPOP TO KEEP YELLY FROM YELLING.
TILL THE MOMENT ARRIVED WHEN A BOY FELT THE NEED TO TAKE HER LOLLYPOP. THEN, EVERYTHING CAME TO A STOP.
AAAAAH!
DAMN.



IT CAME AS A SURPRISE WHEN YELLY GREW UP TO BE A TEACHER. SHE HAD A SPECIAL CLASSROOM, IT WAS IN SYNC WITH NATURE – OUT IN THE OPEN. WHEN YELLY YELLED, NOTHING BROKE.

BUT SOMETHING WAS BREWING, SOMETHING OUT OF THE WORLD WAS IN STORE.

YELLY GOT AN EMAIL. IT CAME FROM KHAAB (KEEP HARMFUL ALIENS AT BAY), AN ORGANIZATION VERY HIDDEN. THEY HAD A TASK FOR YELLY, A GREAT MISSION.

YELLY WENT TO MEET THEM SOON ENOUGH, NO DOUBT. ALL THEY WANTED HER TO DO WAS ... ER .. SHOUT?

YELLY GOT TO WORK. HER YELL WENT ALL THE WAY. IN FACT, IT DID SAVE THE DAY.

AND THE FAMILIAR SCENE ... WHENEVER AN ENEMY ALIEN SPACESHIP ENTERED THE EARTH's ATMOSPHERE.

YELLY IS NOW A PART OF THE KEEP HARMFUL ALIENS AT BAY FAMILY. A SECRET CELEBRITY WITH THE YELLERS, THEY SAY!

abcdef
ghij
klmn
opqrs
Email
keep Aliens at Bay ... 1 new
Office ... 0 new
Home ... 1 new
Welcome to Keep Harmful Aliens At Bay. We send all kinds of sounds in to the stratosphere to keep nasty aliens away and attract the friendly ones. Your voice can be very useful.
AAAAAH!
DAMN!
HURRAY!

TRAIN TO SUCCESS

by **Priyanka Talreja**

There is huge popularity for pop music. While some singers work their way to the top, others get lucky, thanks to social media. Let's take a look at the journeys of two sensational teen pop icons.

YOUTUBED

Justin Bieber

March 1, 1994; London, Canada.

Childhood years: Justin Drew Bieber saw a difficult childhood as his mother was a single parent and worked at a series of low-paying office jobs to raise him.

Interests: While growing up, Justin displayed an interest in hockey, soccer and chess, and kept his musical aspirations to himself.

Journey to fame: At the age of 12, Bieber sang for a local singing competition and stood second. His mother posted a video of this recording on YouTube for family and friends, and she continued doing that regularly.

The big break: In 2008, an American talent manager, Scooter Braun, was looking for new talent. He happened to come across Bieber's videos on YouTube and offered to fly him down to Georgia and record demo tapes. Within a week, Bieber was recording a song with the pop icon, *Usher*.

Celebrity status: 44mn Twitter followers! His fans call themselves 'Beliebers'. But, his singing capabilities have been questioned by critics.

TRAINED

Katy Perry

October 25, 1984; California, USA

Childhood years: Katheryn Elizabeth Hudson was born in a highly conservative family. Perry's parents refused to let her listen to any rock or popular music. It was only gospel music that she was exposed to.

Interests: Perry was always interested in singing. She started taking lessons at the age of 9 and learned to play guitar when she was 13.

Journey to fame: When Perry was 15, her singing in church caught the attention of rock veterans. They took her to Nashville, where she learnt how to craft songs and play the guitar.

The big break: After a series of flops, Perry's album, *One of the Boys* got her commercial fame in June 17, 2008. This album has now reached number nine on the Billboard 200, and is certified platinum by the Recording Industry Association of America.

Celebrity status: 40mn Twitter followers! ■

Artwork: Kashmira Sarode

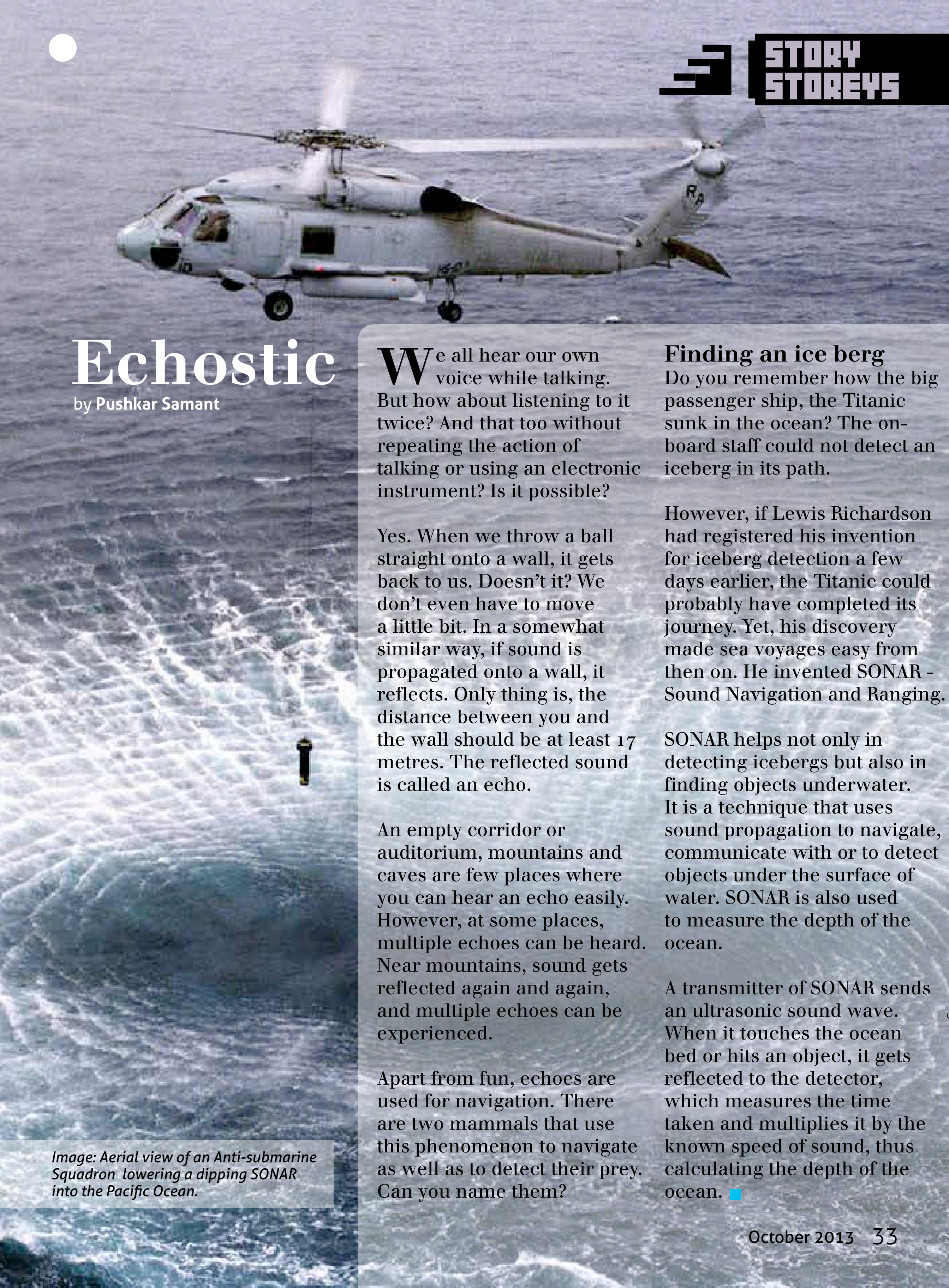


Image: Aerial view of an Anti-submarine Squadron lowering a dipping SONAR into the Pacific Ocean.

Echostic

by **Pushkar Samant**

We all hear our own voice while talking. But how about listening to it twice? And that too without repeating the action of talking or using an electronic instrument? Is it possible?

Yes. When we throw a ball straight onto a wall, it gets back to us. Doesn't it? We don't even have to move a little bit. In a somewhat similar way, if sound is propagated onto a wall, it reflects. Only thing is, the distance between you and the wall should be at least 17 metres. The reflected sound is called an echo.

An empty corridor or auditorium, mountains and caves are few places where you can hear an echo easily. However, at some places, multiple echoes can be heard. Near mountains, sound gets reflected again and again, and multiple echoes can be experienced.

Apart from fun, echoes are used for navigation. There are two mammals that use this phenomenon to navigate as well as to detect their prey. Can you name them?

Finding an ice berg

Do you remember how the big passenger ship, the Titanic sunk in the ocean? The on-board staff could not detect an iceberg in its path.

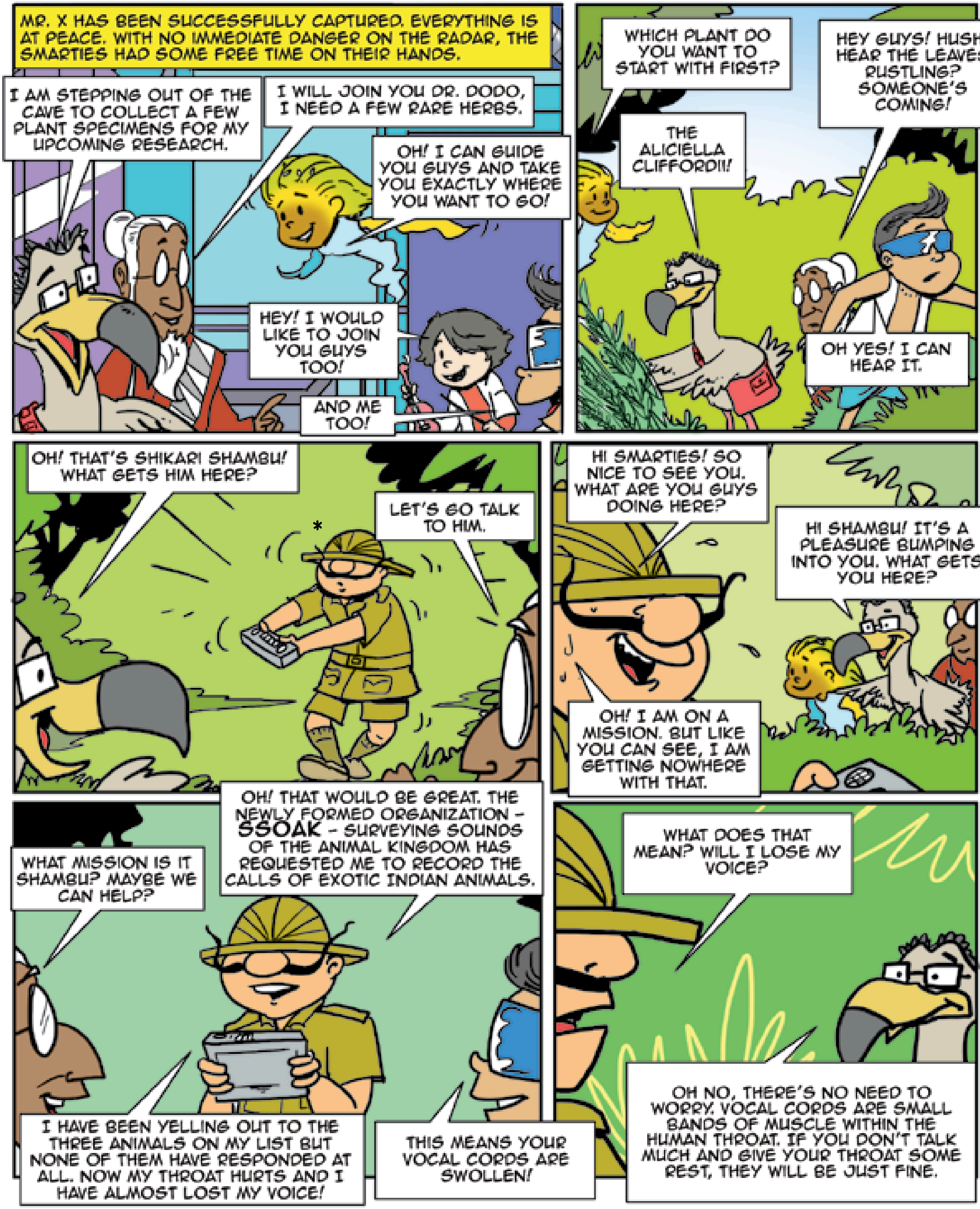
However, if Lewis Richardson had registered his invention for iceberg detection a few days earlier, the Titanic could probably have completed its journey. Yet, his discovery made sea voyages easy from then on. He invented SONAR - Sound Navigation and Ranging.

SONAR helps not only in detecting icebergs but also in finding objects underwater. It is a technique that uses sound propagation to navigate, communicate with or to detect objects under the surface of water. SONAR is also used to measure the depth of the ocean.

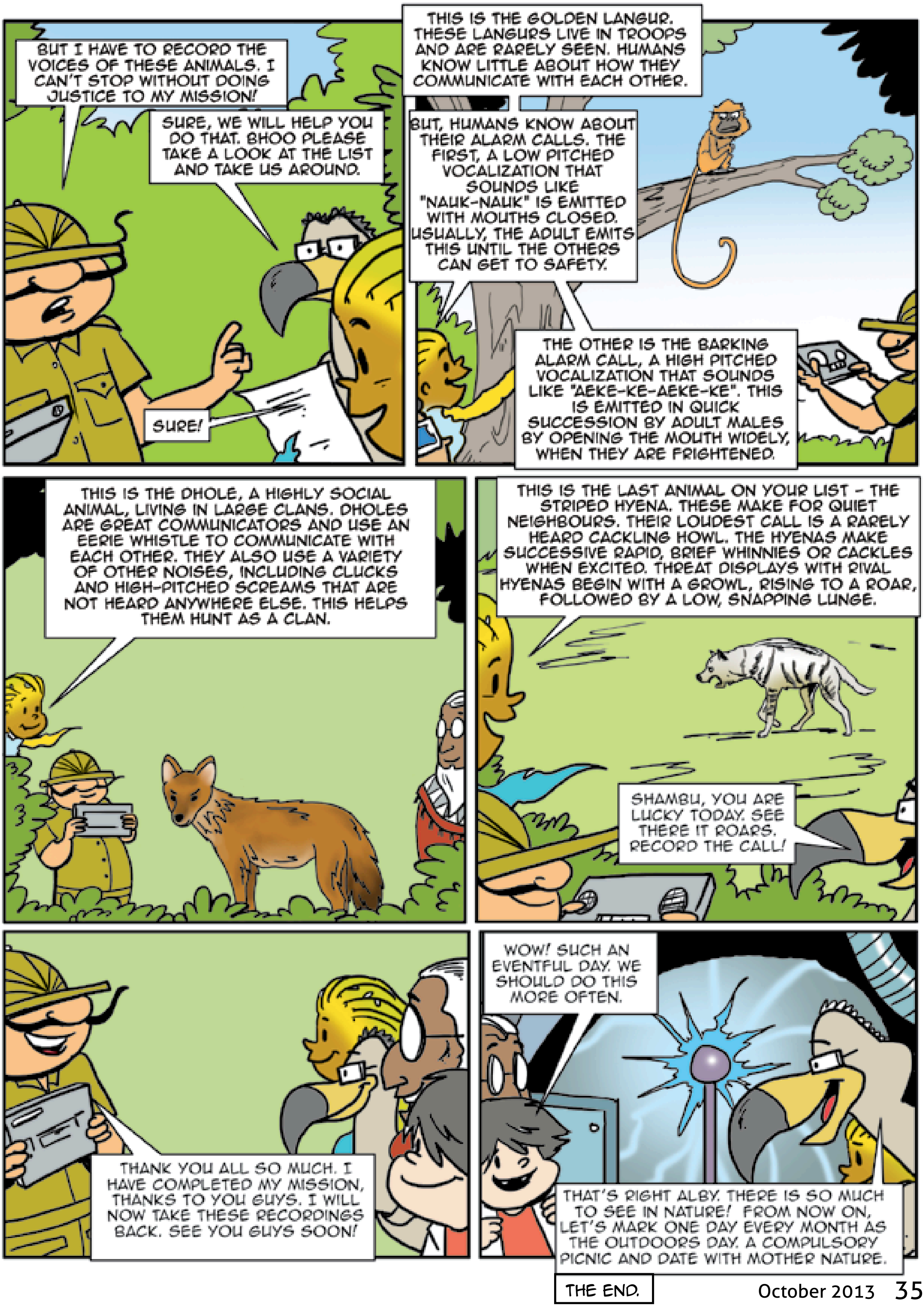
A transmitter of SONAR sends an ultrasonic sound wave. When it touches the ocean bed or hits an object, it gets reflected to the detector, which measures the time taken and multiplies it by the known speed of sound, thus calculating the depth of the ocean. ■

THE SMARTIES THE OUTDOORS DAY

STORY: PRIYANKA TALREJA ART & LETTERING: ABHIJEET KINI

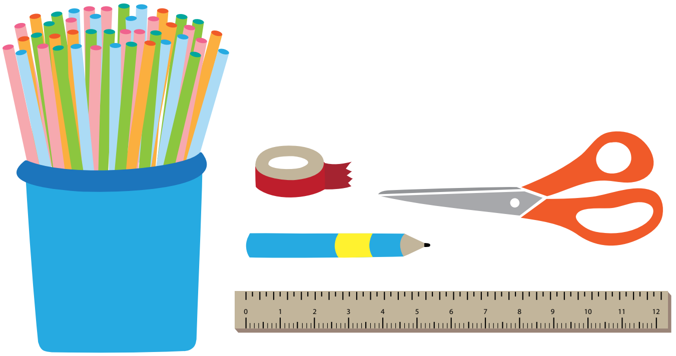

MR. X HAS BEEN SUCCESSFULLY CAPTURED. EVERYTHING IS AT PEACE. WITH NO IMMEDIATE DANGER ON THE RADAR, THE SMARTIES HAD SOME FREE TIME ON THEIR HANDS.
I AM STEPPING OUT OF THE CAVE TO COLLECT A FEW PLANT SPECIMENS FOR MY UPCOMING RESEARCH.
I WILL JOIN YOU DR. DODO, I NEED A FEW RARE HERBS.
OH! I CAN GUIDE YOU GUYS AND TAKE YOU EXACTLY WHERE YOU WANT TO GO!
HEY! I WOULD LIKE TO JOIN YOU GUYS TOO!
AND ME TOO!
WHICH PLANT DO YOU WANT TO START WITH FIRST?
THE ALICIELLA CLIFFORDII!
HEY GUYS! HUSH! HEAR THE LEAVES RUSTLING? SOMEONE'S COMING!
OH YES! I CAN HEAR IT.
OH! THAT'S SHIKARI SHAMBU! WHAT GETS HIM HERE?
*
LET'S GO TALK TO HIM.
HI SMARTIES! SO NICE TO SEE YOU. WHAT ARE YOU GUYS DOING HERE?
HI SHAMBU! IT'S A PLEASURE BUMPING INTO YOU. WHAT GETS YOU HERE?
OH! I AM ON A MISSION. BUT LIKE YOU CAN SEE, I AM GETTING NOWHERE WITH THAT.
WHAT MISSION IS IT SHAMBU? MAYBE WE CAN HELP?
OH! THAT WOULD BE GREAT. THE NEWLY FORMED ORGANIZATION - SSOAK - SURVEYING SOUNDS OF THE ANIMAL KINGDOM HAS REQUESTED ME TO RECORD THE CALLS OF EXOTIC INDIAN ANIMALS.
I HAVE BEEN YELLING OUT TO THE THREE ANIMALS ON MY LIST BUT NONE OF THEM HAVE RESPONDED AT ALL. NOW MY THROAT HURTS AND I HAVE ALMOST LOST MY VOICE!
THIS MEANS YOUR VOCAL CORDS ARE SWOLLEN!
WHAT DOES THAT MEAN? WILL I LOSE MY VOICE?
OH NO, THERE'S NO NEED TO WORRY. VOCAL CORDS ARE SMALL BANDS OF MUSCLE WITHIN THE HUMAN THROAT. IF YOU DON'T TALK MUCH AND GIVE YOUR THROAT SOME REST, THEY WILL BE JUST FINE.

*Special appearance by Shikari Shambu of *Tinkle*


BUT I HAVE TO RECORD THE VOICES OF THESE ANIMALS. I CAN'T STOP WITHOUT DOING JUSTICE TO MY MISSION!
SURE, WE WILL HELP YOU DO THAT. BHOO PLEASE TAKE A LOOK AT THE LIST AND TAKE US AROUND.
SURE!
THIS IS THE GOLDEN LANGUR. THESE LANGURS LIVE IN TROOPS AND ARE RARELY SEEN. HUMANS KNOW LITTLE ABOUT HOW THEY COMMUNICATE WITH EACH OTHER.
BUT, HUMANS KNOW ABOUT THEIR ALARM CALLS. THE FIRST, A LOW PITCHED VOCALIZATION THAT SOUNDS LIKE "NAUK-NAUK" IS EMITTED WITH MOUTHS CLOSED. USUALLY, THE ADULT EMITS THIS UNTIL THE OTHERS CAN GET TO SAFETY.
THE OTHER IS THE BARKING ALARM CALL, A HIGH PITCHED VOCALIZATION THAT SOUNDS LIKE "AEKE-KE-AEKE-KE". THIS IS EMITTED IN QUICK SUCCESSION BY ADULT MALES BY OPENING THE MOUTH WIDELY, WHEN THEY ARE FRIGHTENED.
THIS IS THE DHOLE, A HIGHLY SOCIAL ANIMAL, LIVING IN LARGE CLANS. DHOLES ARE GREAT COMMUNICATORS AND USE AN EERIE WHISTLE TO COMMUNICATE WITH EACH OTHER. THEY ALSO USE A VARIETY OF OTHER NOISES, INCLUDING CLUCKS AND HIGH-PITCHED SCREAMS THAT ARE NOT HEARD ANYWHERE ELSE. THIS HELPS THEM HUNT AS A CLAN.
THIS IS THE LAST ANIMAL ON YOUR LIST - THE STRIPED HYENA. THESE MAKE FOR QUIET NEIGHBOURS. THEIR LOUDEST CALL IS A RARELY HEARD CACKLING HOWL. THE HYENAS MAKE SUCCESSIVE RAPID, BRIEF WHINNIES OR CACKLES WHEN EXCITED. THREAT DISPLAYS WITH RIVAL HYENAS BEGIN WITH A GROWL, RISING TO A ROAR, FOLLOWED BY A LOW, SNAPPING LUNGE.
SHAMBU, YOU ARE LUCKY TODAY. SEE THERE IT ROARS. RECORD THE CALL!
THANK YOU ALL SO MUCH. I HAVE COMPLETED MY MISSION, THANKS TO YOU GUYS. I WILL NOW TAKE THESE RECORDINGS BACK. SEE YOU GUYS SOON!
WOW! SUCH AN EVENTFUL DAY. WE SHOULD DO THIS MORE OFTEN.
THAT'S RIGHT ALBY. THERE IS SO MUCH TO SEE IN NATURE! FROM NOW ON, LET'S MARK ONE DAY EVERY MONTH AS THE OUTDOORS DAY. A COMPULSORY PICNIC AND DATE WITH MOTHER NATURE.
THE END.

See how sound waves travel

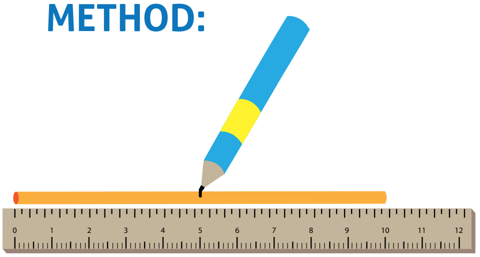
by **Kayomarz Bacha**



You need:

- 80 – 90 drinking straws
- Cellotape / electric tape
- Scale
- Marker
- Scissors

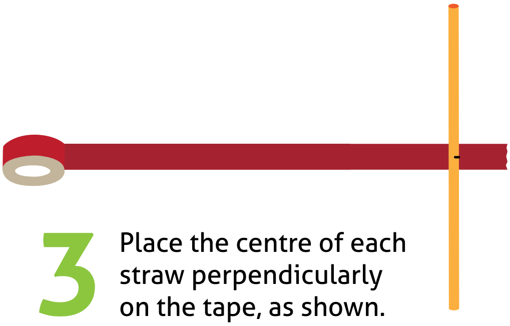
METHOD:



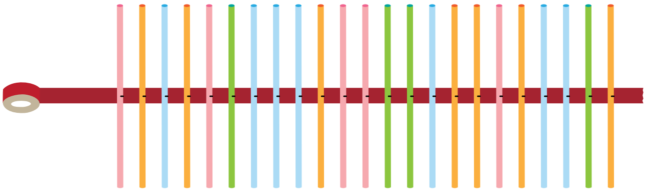
1 Using the scale and marker, mark the midpoint of all the straws.

2 Take about 3 metres of tape and place it on the ground, sticky side up.

Artwork: Kashmira Sarode

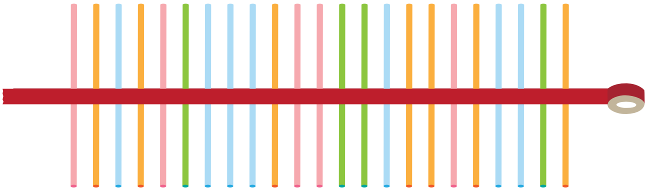


3 Place the centre of each straw perpendicularly on the tape, as shown.



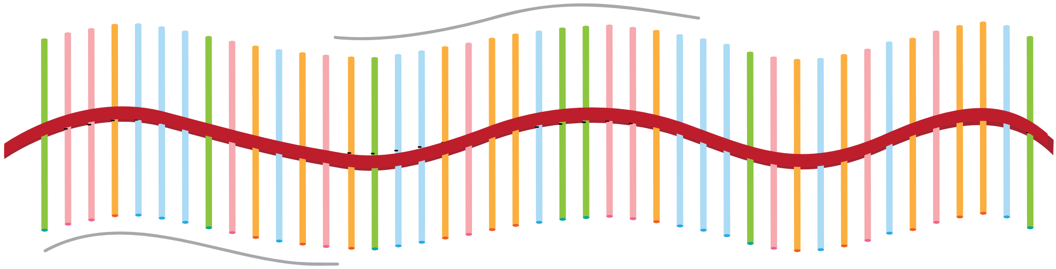
4 Place all the straws in line, 2 cms apart from each other, as shown.

Watch the video at: *www.youtube.com/watch?v=sdeLpw8niBI*

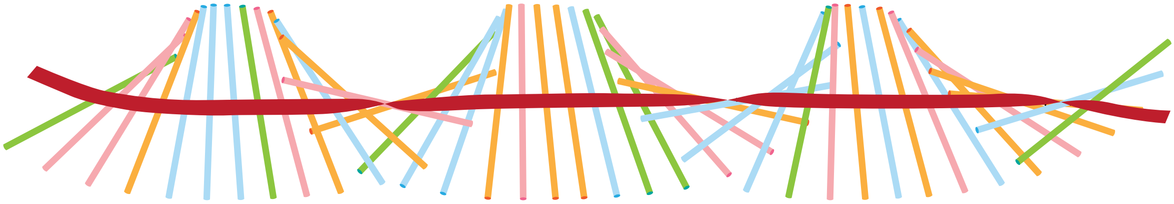


5 Stick another 3 metres of tape over the straws and the 1st layer, sticky side down.

NOTE: Sandwich the straws between the 2 layers of tape.



6 Ask a friend to hold one end of the tape. You hold the other end tightly and give it a tap.



You can also:

1. Hold the model loose and notice the difference in the vibration when you flick it.
2. Twist one end and see if there is a difference in the way the vibration travels.

Why does this happen?

You will notice that if you tap even the 1st straw, all the straws vibrate one after the other. If you notice closely, you will observe that the vibration reflects off your friends hands and travels back to you.

When sound waves are emitted, they vibrate and cause the surrounding molecules to vibrate, enabling us to hear a particular sound at a particular frequency and pitch.

Similarly, here each straw vibrates making the straw next to it vibrate and so on. When you twist one end of the model you will notice troughs and crests being formed. This explains the transmission of energy.

What are frequencies and wavelengths? What's the difference? Research and email your answers to *brainwave@ack-media.com*. The best answer wins 2 cool ACK comic books!

Treasure Hunt!

The Treasure Hunt is here. Take your magnifying glass out and become the adventurer. This month, we have a list of clues strewn across the magazine. Each clue is represented by a ☞ symbol.

The treasure you have to unearth is the theme of the next issue. Read the magazine carefully, spot the clues and get cracking.

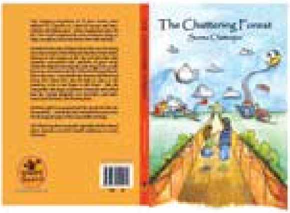
∘∘∘∘∘∘∘∘∘

What are you still waiting for? Get started - the top two entries will win two cool books each from Leadstart Publishing.

Email your answers to brainwave@ack-media.com with 'Treasure Hunt' as the subject.

LEADSTART
Publishing

2 WINNERS GET 2 COOL BOOKS, EXCLUSIVE FROM LEADSTART PUBLISHING!



Be a Smartenstein!

We run more than ten activities and contests in each issue. They can win you many exciting prizes.

Participate in all the activites of an issue, and you can win a merit certificate, the title 'Smartenstein' and a mystery gift - every month!

There are more than 10 activities and contests in this issue. Turn to the index on p02, check the features marked with a '★' out, and participate in them.

What are you waiting for? We have even introduced a contest by Hobby Ideas that gives you cool gift hampers - on p07!

www.bwmag.in/category/bw-smartenstein

Artwork: Sarthak Sinha

Join the BW FUN-DO BAND

Win gifts throughout the year while you learn with fun!

Every month, the best team wins goodie-bags with posters, comics, CDs, cool BW friendship bands and more.

At the end of each year, the top 5 teams win the BW Fun-do Band 'Hall-of-Fame' certificates, mementos and t-shirts! The topmost team will also win a rolling shield.

www.bwmag.in/fun-do-band

5 easy steps!

Step 1

Form a team with four other friends who are not subscribers of Brainwave.

Step 2

Give your team a name (e.g. The Smartensteins) and choose a captain.

Step 3

Email the full names of your team, members and captain to brainwave@ack-media.com

Step 4

Click on the website link that we email to each of you and register.

Step 5

As a team, perform DIY, Toy Box, Eye See and Magic Science experiments every month. Submit your observations and start winning!

Go, gather your friends now and have five times the fun!

BW SCIENCE SUPER-TEACHER

We all have teachers who inspire us to love science and to ask questions with an open mind. They could be at school or they could be friends and family members. Nominate them for the BW science super-teacher awards and let the world know about them!
If your nominee wins, you get a cool gift too!

Email their name and school along with 100 words on why you are nominating them to brainwave@ack-media.com

www.bwmag.in/bw-super-science-teacher-awards

The Sound of Music

by **Joanne Carlo**

What possibly could a bat, an elephant and a blue whale have in common?

Wait! Before you think of something supernaturally gross, it's the sound of music. No, not the movie starring Julie Andrews! But the musical sounds each of these mammals emit, to communicate. Their calls are so simple yet precise, its almost like we humans learnt how to communicate from them.

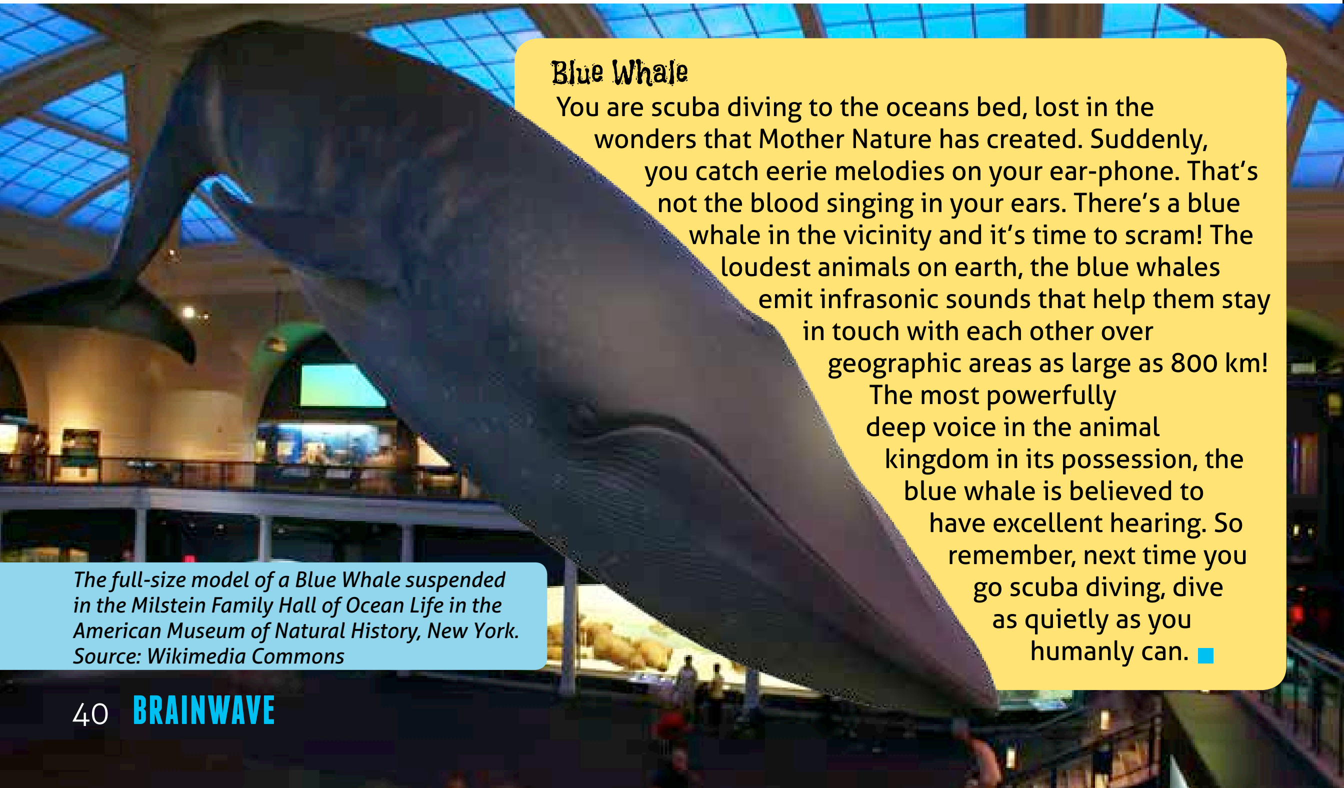
Elephant

As you silently tiptoe towards the cookie jar, remember that 10 kilometres away, elephants can hear you loud and clear. The vocabulary of elephants is very vast – but even though their range of sounds spans 10 octaves[G], they mostly communicate through low frequency sounds called rumbling. Vital to their survival, these gentle giants have the ability to judge distances from one another based on the pitch of each other's infrasonic calls.

Bat

While we need to visit deep valleys, yell our names at the top of our voices and wait for echoes, the bat does it all in a heartbeat. It emits ultrasonic sounds that produce echoes - giving the bat a detailed visual of his surroundings. This allows the bat to detect, localize and classify its prey in complete darkness.

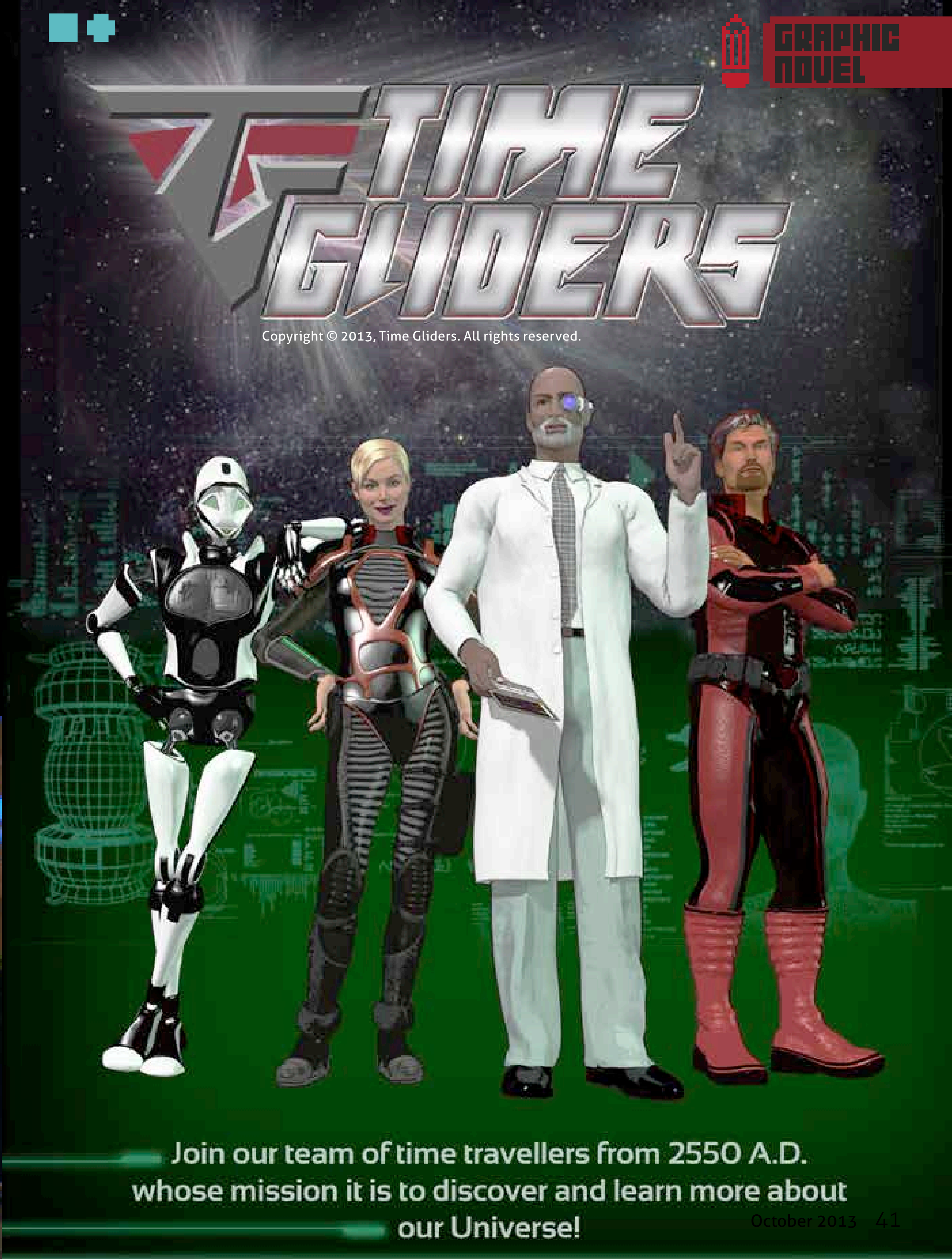
Image Source: Wikimedia Commons



The full-size model of a Blue Whale suspended in the Milstein Family Hall of Ocean Life in the American Museum of Natural History, New York. Source: Wikimedia Commons

Blue Whale

You are scuba diving to the oceans bed, lost in the wonders that Mother Nature has created. Suddenly, you catch eerie melodies on your ear-phone. That's not the blood singing in your ears. There's a blue whale in the vicinity and it's time to scram! The loudest animals on earth, the blue whales emit infrasonic sounds that help them stay in touch with each other over geographic areas as large as 800 km! The most powerfully deep voice in the animal kingdom in its possession, the blue whale is believed to have excellent hearing. So remember, next time you go scuba diving, dive as quietly as you humanly can. ■


TIME GLIDERS
Join our team of time travellers from 2550 A.D. whose mission it is to discover and learn more about our Universe!

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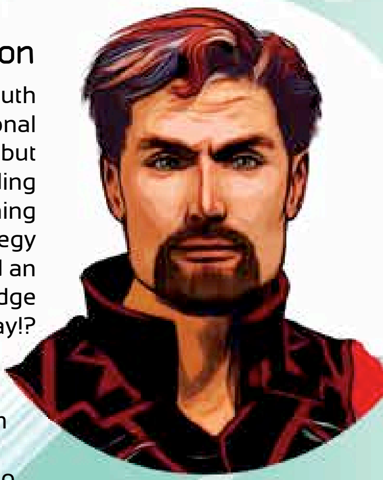
Meet the team

By 2550 A.D., time travel has been perfected. This leads to the Time Glider project, run by a consortium of science and engineering departments from all over the world. The aim is to gain a better understanding of certain difficult, science-related issues. There are various Time Glider teams, but the first mission belongs to TG-1, the spacecraft commandeered by professor Patel.

Time Gliders Command has one directive: TG teams are assigned to discover and explore, but are under no circumstances allowed to interfere with human history. This may cause uncontrollable ripple effects that may jeopardize the very future existence of the Time Gliders agency!

Professor Patel

Commander of TG-1, and co-founder of the International Time Gliders Agency, he is commonly known as ”Prof“. Born in Kolkata, India, he boasts of several Nobel prizes in the natural sciences. His specialty is quantum physics and string theory, frequently causing him sleepless nights. It is no secret that Prof loves hot curry, which, according to him, helps him ”to think better“.

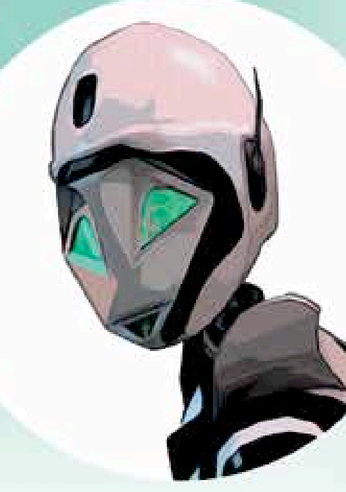


Deon

Pilot, and in charge of security. Born in Pretoria, South Africa, Deon is a new recruit from the International Space Flight Academy, and ready for adventure but tends to be somewhat impulsive at times, finding himself in dangerous situations. Deon loves anything that is fast. As a kid, he was a champion in strategy games on the Play Station 999, and developed an interest in human history. Who knew that his knowledge on this subject would come in handy someday!?

Liz

Engineer and data analyst. Born and raised on a farm in Australia, she loves helping her dad fix equipment rather than playing with dolls. She sometimes got into trouble at school after altering machines to ”improve“ them without permission! Liz developed a special interest in nanotechnology and endeavors to one day receive the Nobel Prize in this field.

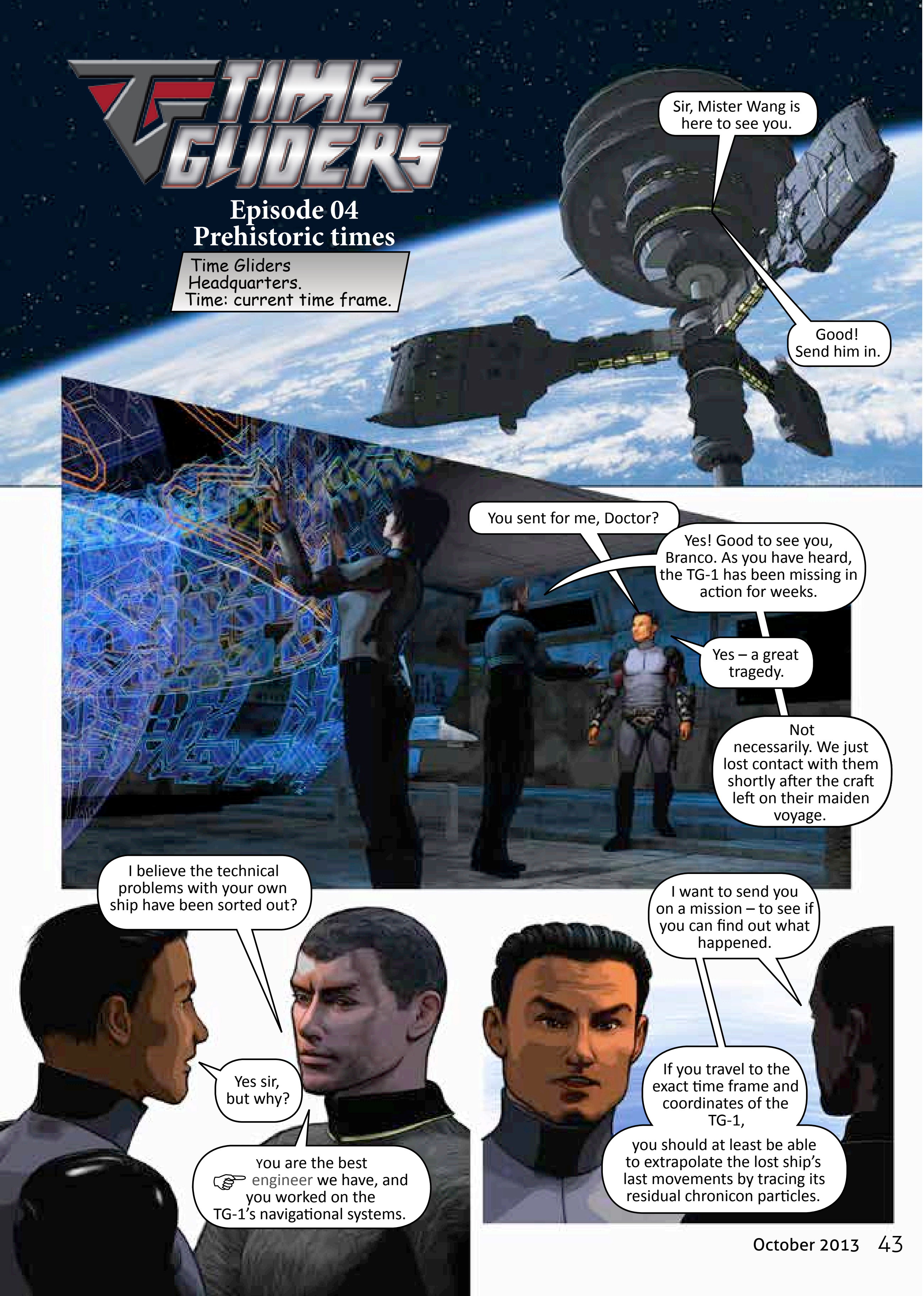


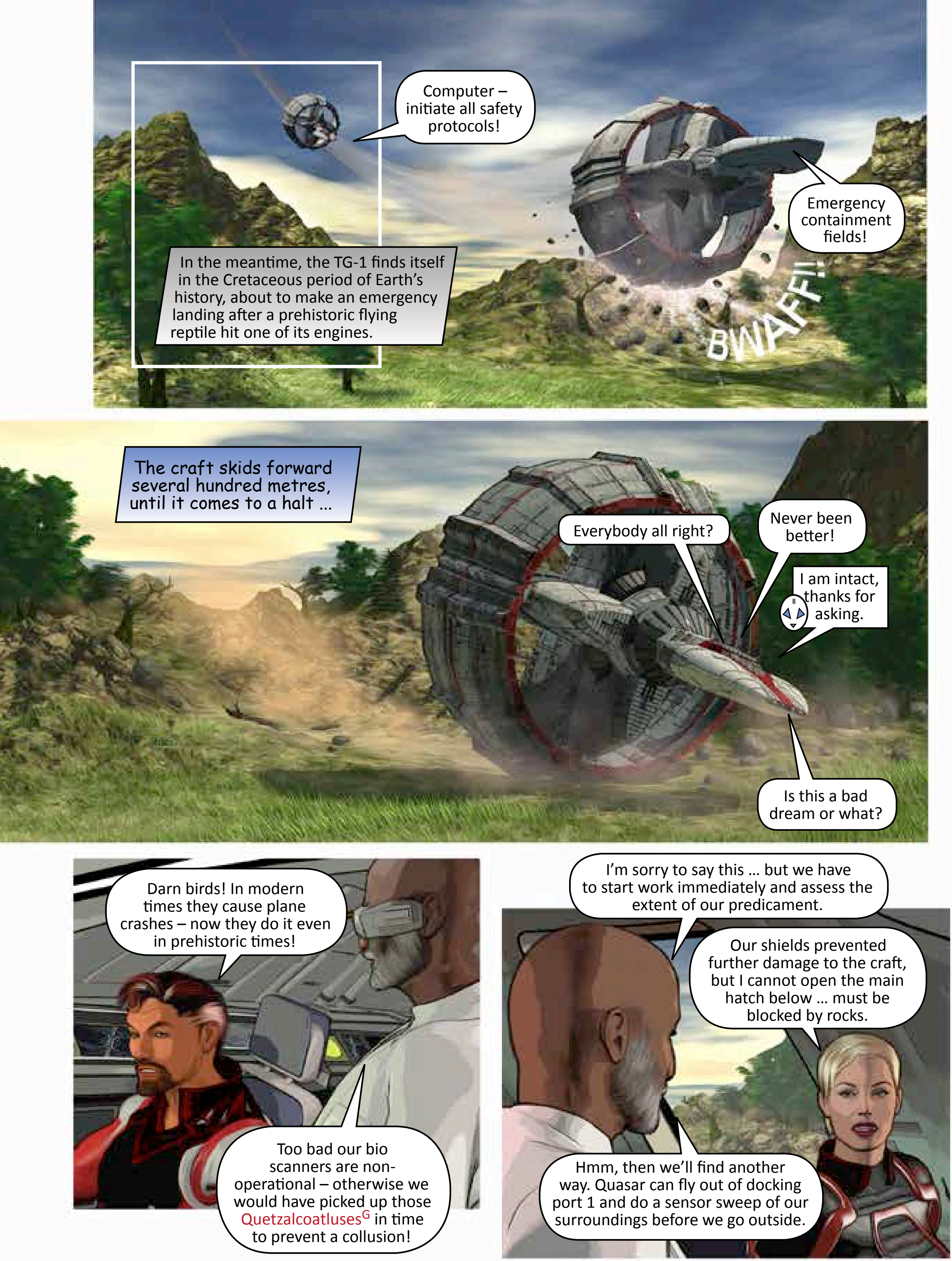
Quasar

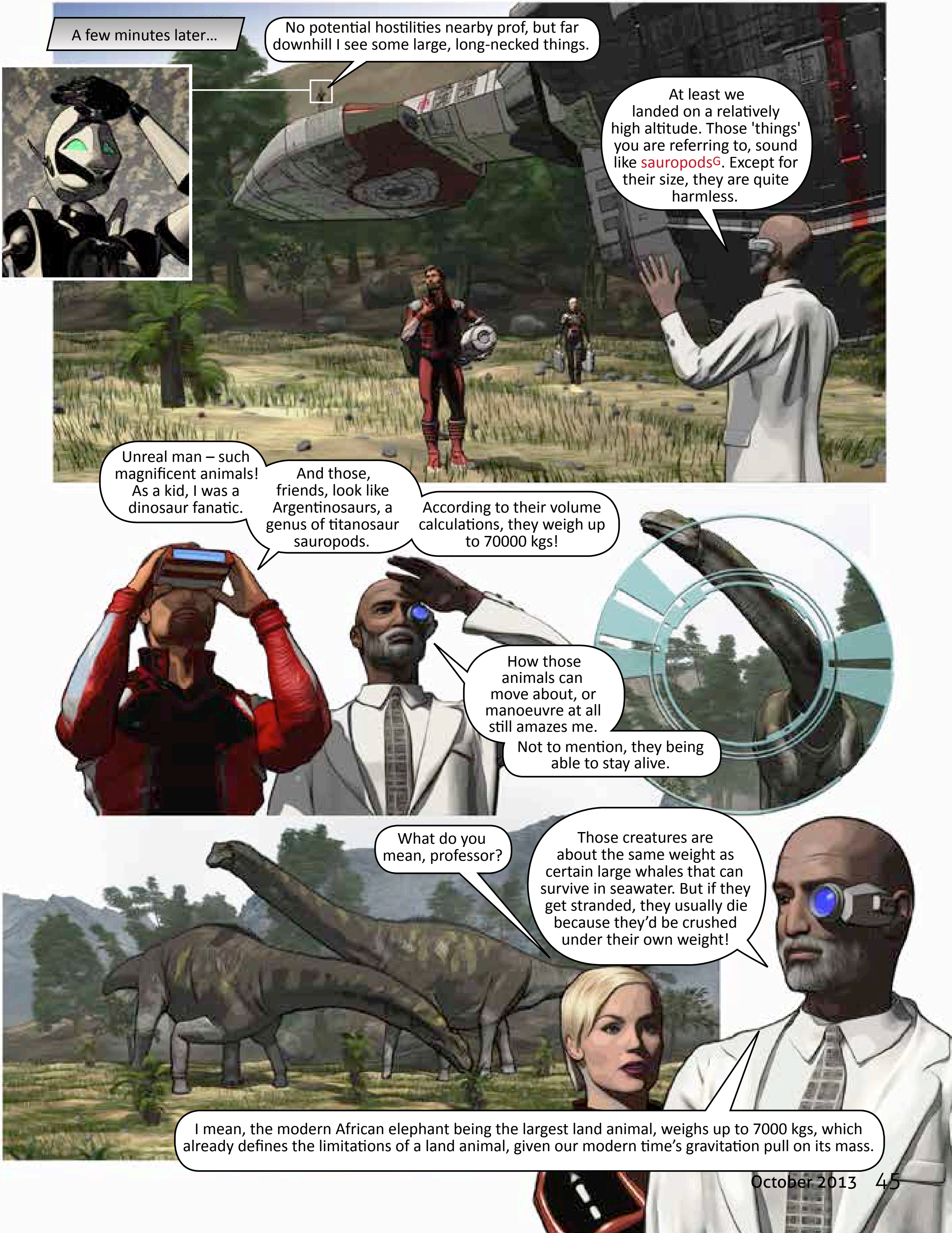
Logistics and timeline navigator. Quasar is, well, basically from all over the world. He was conceived in a Japanese robotics laboratory, but developed further in India. Most of his parts are from China, but he was finally assembled in Germany. Having a limited capacity to experience human-like emotions, it is no wonder he is wrestling somewhat to find his own identity. Quasar has a special taste for Castrol lubricants as it helps keep his joints in tip-top shape.

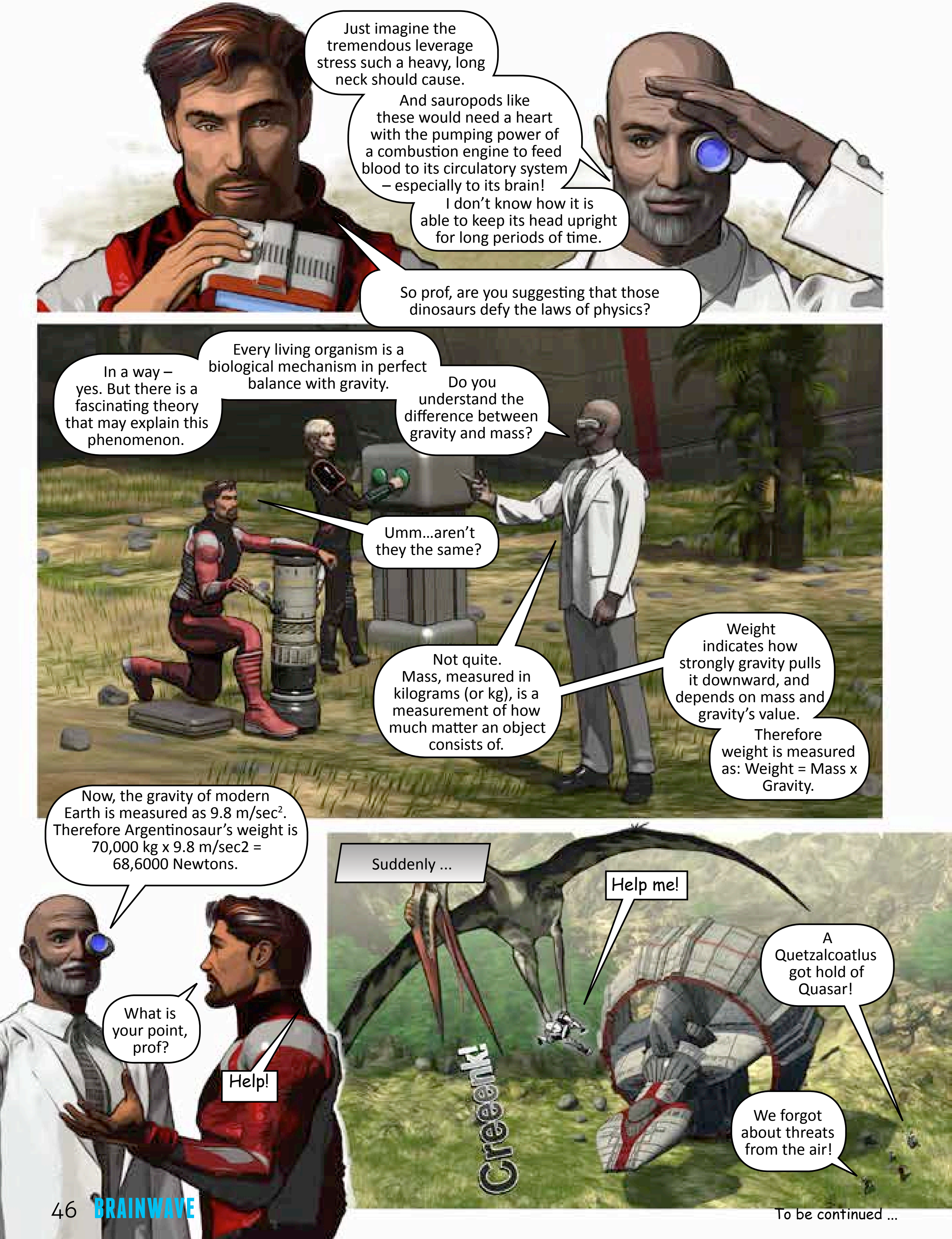
TIME GLIDERS

Episode 04
Prehistoric times


Time Gliders Headquarters. Time: current time frame.
Sir, Mister Wang is here to see you.
Good! Send him in.
You sent for me, Doctor?
Yes! Good to see you, Branco. As you have heard, the TG-1 has been missing in action for weeks.
Yes – a great tragedy.
Not necessarily. We just lost contact with them shortly after the craft left on their maiden voyage.
I believe the technical problems with your own ship have been sorted out?
Yes sir, but why?
☞ You are the best engineer we have, and you worked on the TG-1's navigational systems.
I want to send you on a mission – to see if you can find out what happened.
If you travel to the exact time frame and coordinates of the TG-1,
you should at least be able to extrapolate the lost ship's last movements by tracing its residual chronicon particles.


In the meantime, the TG-1 finds itself in the Cretaceous period of Earth's history, about to make an emergency landing after a prehistoric flying reptile hit one of its engines.
Computer – initiate all safety protocols!
Emergency containment fields!
BWAFF!
The craft skids forward several hundred metres, until it comes to a halt ...
Everybody all right?
Never been better!
I am intact, thanks for asking.
Is this a bad dream or what?
Darn birds! In modern times they cause plane crashes – now they do it even in prehistoric times!
Too bad our bio scanners are non-operational – otherwise we would have picked up those Quetzalcoatluses^G in time to prevent a collusion!
I'm sorry to say this ... but we have to start work immediately and assess the extent of our predicament.
Our shields prevented further damage to the craft, but I cannot open the main hatch below ... must be blocked by rocks.
Hmm, then we'll find another way. Quasar can fly out of docking port 1 and do a sensor sweep of our surroundings before we go outside.


A few minutes later...
No potential hostilities nearby prof, but far downhill I see some large, long-necked things.
At least we landed on a relatively high altitude. Those 'things' you are referring to, sound like sauropods[G]. Except for their size, they are quite harmless.
Unreal man – such magnificent animals! As a kid, I was a dinosaur fanatic.
And those, friends, look like Argentinosaurs, a genus of titanosaur sauropods.
According to their volume calculations, they weigh up to 70000 kgs!
How those animals can move about, or manoeuvre at all still amazes me.
Not to mention, they being able to stay alive.
What do you mean, professor?
Those creatures are about the same weight as certain large whales that can survive in seawater. But if they get stranded, they usually die because they'd be crushed under their own weight!
I mean, the modern African elephant being the largest land animal, weighs up to 7000 kgs, which already defines the limitations of a land animal, given our modern time's gravitation pull on its mass.


Just imagine the tremendous leverage stress such a heavy, long neck should cause.
And sauropods like these would need a heart with the pumping power of a combustion engine to feed blood to its circulatory system – especially to its brain!
I don't know how it is able to keep its head upright for long periods of time.
So prof, are you suggesting that those dinosaurs defy the laws of physics?
In a way – yes. But there is a fascinating theory that may explain this phenomenon.
Every living organism is a biological mechanism in perfect balance with gravity.
Do you understand the difference between gravity and mass?
Umm...aren't they the same?
Not quite. Mass, measured in kilograms (or kg), is a measurement of how much matter an object consists of.
Weight indicates how strongly gravity pulls it downward, and depends on mass and gravity's value.
Therefore weight is measured as: Weight = Mass x Gravity.
Now, the gravity of modern Earth is measured as 9.8 m/sec^2. Therefore Argentinosaur's weight is 70,000 kg x 9.8 m/sec2 = 68,6000 Newtons.
What is your point, prof?
Help!
Suddenly ...
Help me!
Creeeenk!
A Quetzalcoatlus got hold of Quasar!
We forgot about threats from the air!

To be continued ...

SCIENCE GLOSSARY

p11

Dopamine: Chemical messenger that controls the brain's reward and pleasure centers.

p11

Air-breathing Jet Engine: Jet engine propelled by a jet of hot exhaust gases formed from air that is drawn into the engine via an inlet duct.

Unmanned Scramjet: A kind of airbreathing jet engine in which combustion takes place in faster than speed of sound airflow. Unmanned implies that the jet has no human pilot on board.

p12

Patent: A set of exclusive rights granted by a country to inventors or their assignees for a limited period of time. This enables inventors to disclose their invention without the fear of someone else copying it.

p18

Polyphonic Music: Music consisting of two or more simultaneous lines of independent melody, as opposed to music with just one voice.

Theremin: A unique musical instrument that is played without physical contact. The musician stands in front of the instrument and moves his or her hands in the proximity of two metal antennas. The distance from one antenna determines frequency (pitch), and the distance from the other controls amplitude (volume).

p11

Ionize: The process by which an atom or a molecule acquires a negative or positive charge by gaining or losing electrons.

p40

Octaves: Interval between one musical pitch and another of half or double its frequency. E.g: if one note has a frequency of 440 Hz, the note an octave above it is at 880 Hz, and the note an octave below is at 220 Hz.

p44

Quetzalcoatluses: Flying reptiles that existed 220-65 million years ago. They have an estimated wingspan of 30-35 ft.

p45

Sauropods: Sauropods are dinosaurs that had very long necks, long tails, small heads in comparison to the rest of their body, and thick, pillar-like legs. They are notable for their enormous sizes.

Spot The Errors

Finished reading the magazine? We have an innovative contest instead of a quiz this time. Win it and a mystery gift worth Rs. 500 is yours!

What you need to do:

There are a few mistakes in this magazine. They are either science or English grammar related. Identify as many of these as you can and email us at brainwave@ackmedia.com

Please ensure that you mention the page and paragraph numbers.

To take part in some cool science initiatives, visit *www.bwmag.in*

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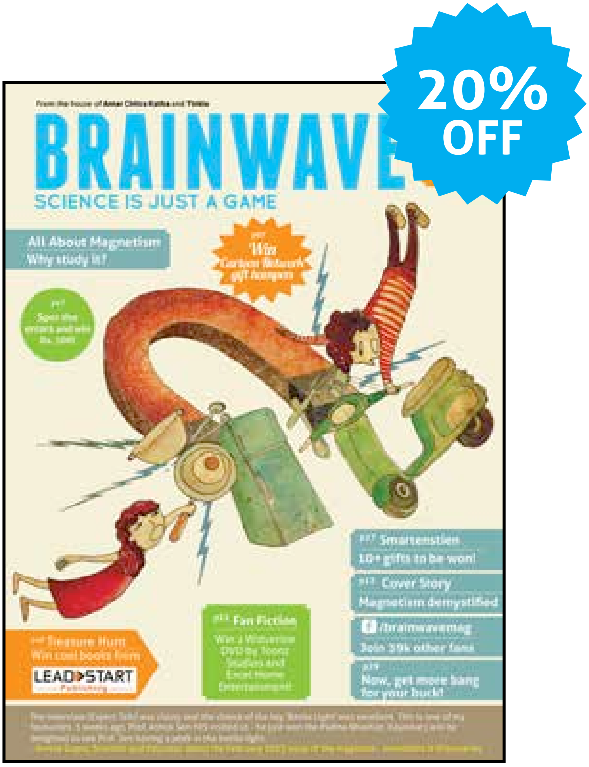

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Why pay ₹ 60 every month (that's ₹720 a year) at your news-stand to enjoy Brainwave?

Now, Brainwave is the perfect balance of science and fun, which will make you call your friends up and say, "Guys, let's play science!"

You get 48+ pages of comics, stories, experiments and contests. There is a Treasure Hunt too! You can win many exciting prizes and even be on our **Student Board**.

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Go Zoooooom!!!

by **Pushkar Samant**

Advanced technology has allowed us to match our speed with that of sound. Here are some examples.

Fastest Free Fall

On October 14, 2012, Felix Baumgartner, a former Australian Paratrooper became the first man to break the speed of sound with his fall from space. After climbing 1,28,100 feet above the Earth with the help of helium balloons, Felix travelled at a speed of 1340.6 km/hr to reach ground level. His landing took 9 minutes only! ■

Image Source: Wikimedia Commons

Supersonic Car

If we brought technologies used for Formula One, jet planes and rockets together, the result would be a Supersonic Car. Rolls Royce's backed Bloodhound Supersonic Car is all set to break the current land speed of 1,228 km/hr and then hit 1600 km/hr. In the next few years we might travel at the speed of sound every day! ■

Go with the wind

How about flying with the wind and winning the race with the speed of sound? With the help of turbojet engines, aircrafts can transport civilians from one place to another. Major supersonic aircrafts today are used for military experiments. Concorde was a supersonic transport plane which flew in 2003 for the last time. Very soon, small business supersonic jets will be up in the air. ■

PLANTS FOR PEACE

by **Pushkar Samant**

Remember Master Shifu of Kung Fu Panda struggling for inner peace? He gets disturbed even when birds flap their wings. Though it takes great effort to gain inner peace, planting trees could grant you some peace.

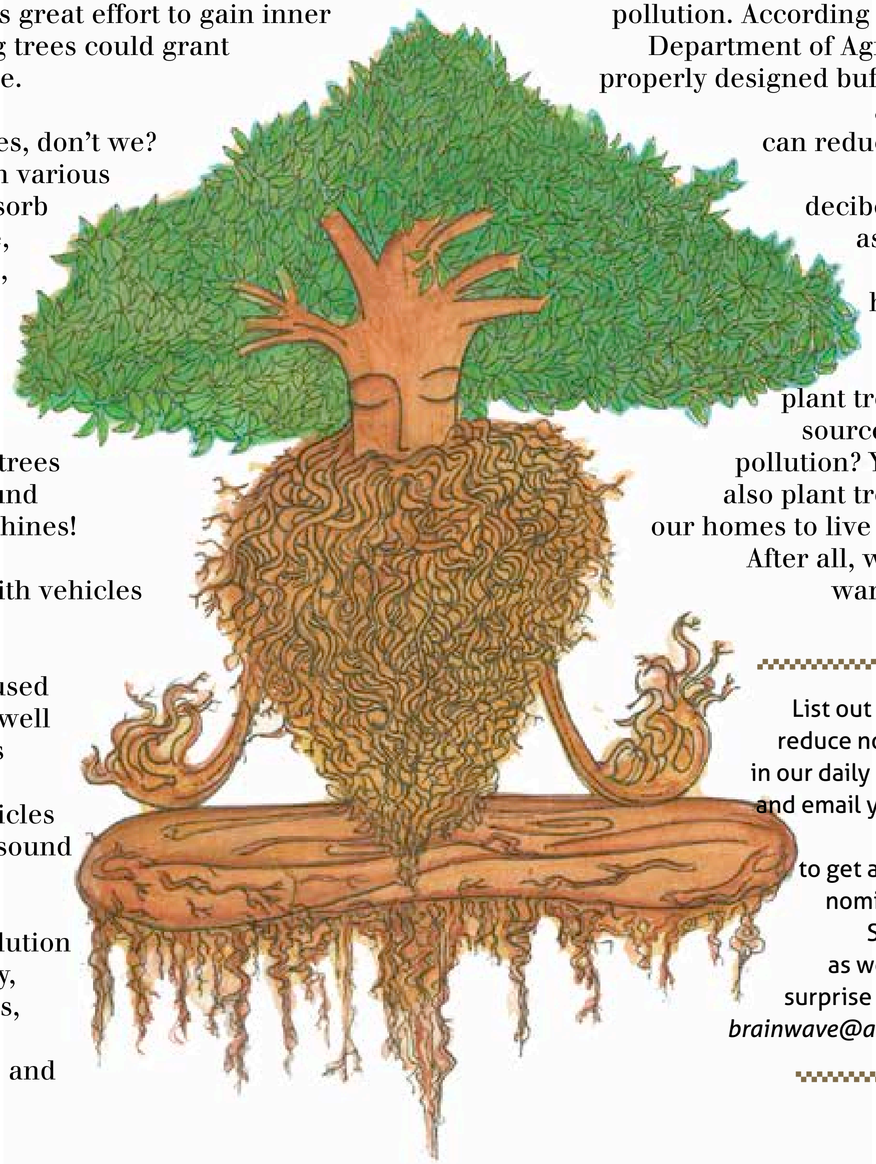
We all love trees, don't we? They help us in various ways - they absorb carbon dioxide, give us oxygen, provide shade, and prevent soil erosion. They also reduce noise pollution. Yes, trees are natural sound absorbing machines!

A road filled with vehicles is messy and noisy, isn't it? Loud noise caused by honking as well as from motors and exhaust systems of vehicles contributes to sound pollution.

Such noise pollution leads to anxiety, sleepless nights, irritation, high blood pressure and many other health problems.

However, planting trees can reduce noise pollution. According to the U. S. Department of Agriculture, a properly designed buffer of trees and shrubs can reduce noise by five to ten decibels or 50%, as perceived by the human ear.

So, can we plant trees around sources of sound pollution? Yes, we can also plant trees around our homes to live peacefully. After all, who doesn't want peace? ■



Artwork: Sarthak Sinha

List out more ways to reduce noise pollution in our daily life. Research and email your solutions to Dr. Dodo to get a chance to be nominated for our Student Board as well as to win a surprise gift! Email: at *brainwave@ack-media.com*

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Brainwave is a children's science magazine from the house of Amar Chitra Katha and Tinkle.

We understand that each child has a different aptitude and love for science. Hence, we simplify science into forms that excite them - comics, stories, fun-do activities, contests and fascinating facts.

Give your child a Brainwave, and science will be just another game!